377415

SUPERFUND PROGRAM RECORD OF DECISION

Crossley Farm Superfund Site
Hereford and Washington Townships
Berks County, Pennsylvania

SEPTEMBER 2001

DECLARATION

SITE NAME AND LOCATION

The Crossley Farm Superfund Site
Hereford and Washington Townships, Berks County, Pennsylvania
EPA ID# PAD981740061

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for the Crossley Farm Site in Hereford and Washington Townships, Berks County, Pennsylvania. The remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"); and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). The basis for EPA's selected remedy can be found in the Administrative Record for the Site.

The Commonwealth of Pennsylvania has concurred with the selected remedy.

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF SELECTED REMEDY

Residual Hot-Spot Plume Pumping and On-Site Treatment

1. The selected remedy is to implement a limited groundwater treatment remedial action for the highest concentration of contamination at the top of Blackhead Hill, the approximate

location is depicted in Figure 12 on page 38. By using a limited number of extraction wells in the "hot spot", the Agency can evaluate the effectiveness of a few wells to decrease concentrations in the groundwater and in the springs down the hill and in the valley. This approach will allow for expansion of the extraction and treatment system as EPA considers which other remedial actions to select in future decision documents for the Site. The expansion could be similar to and include other alternatives described in the Feasibility Study to contain the contamination at the top of the hill and possibly locate additional groundwater treatment systems downgradient in the valley .

This Remedial Alternative will provide treatment of the highest concentration of trichloroethylene (TCE) contamination located immediately downgradient of the borrow pit area using a limited number of extraction wells in the area represented by concentrations above 10^5 or 100,000 ug/l of TCE.

This remedy proposes installation of approximately ten wells in the highest concentration area at depths of approximately 125 and 400 feet to be pumped at a rate of 5 to 30 gallons per minute (gpm).

2. This alternative will require additional groundwater sampling to better delineate the vertical and horizontal extent of contamination and to visually determine if a Dense NonAqueous Phase Liquid (DNAPL) exists. This will be further determined in a remedial design.

3. Groundwater treatment will be at an on-site plant using an air stripping process to transfer the volatile compounds from the groundwater to a vapor phase which can be captured in an off-gas treatment system. The treated water will be run through an additional carbon polishing unit prior to discharge.

4. The recharge system for groundwater would be constructed to discharge the water into the shallow and intermediate aquifer by pumping the treated water to specifically constructed trenches in the wooded areas of the farm or into wells screened in the shallow and intermediate water bearing zones. This will be further determined in a remedial design.

5. This proposed remedial action will require some property on the farm at the top of the hill for long term use to house the equipment for the extraction and treatment remedy as well as for the groundwater recharge system. It will be further determined in a remedial design.

6. The institutional controls would be to monitor the groundwater and restrict the use of. contaminated groundwater at the Site.

Groundwater extraction wells shall not be installed and contaminated groundwater at the Crossley Farm Superfund Site, including but not limited to the areas of Huff's Church Road, Dale Road, Forgedale Road, Dairy Lane, Airport Road and Camp Mench Mill Road shall not be used unless treatment units are installed and maintained to ensure that

any water used has contaminant levels at or below Safe Water Drinking Act (SWDA) - Maximum Contaminant Levels (MCLs) (40 CFR-141). This could be achieved with local government restrictions on the use of groundwater.

7. The June 1997 ROD is now complete and the Pennsylvania Department of Environmental Protection has assumed responsibility for the operation and maintenance of the treatment units installed under that remedial action. Therefore, any new property construction over the contaminated groundwater plume after February 2001 would not receive carbon filtration units paid for by EPA.

8. Groundwater monitoring under this remedy is a remedial action. Sampling of residential wells and springs would be conducted every 6 months.

9. This remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. Pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c), a statutory review by EPA will be conducted no less often than every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

10. Groundwater Remediation Standards for the Hot Spot Area, treated water from the Treatment Plant and treated water from New Construction wells shall meet contaminant levels at or below these Maximum Contaminant Levels:

1. cis-1,2- dichloroethylene	0.07 mg/l
2. Tetrachloroethylene	0.005 mg/l
3. Trichloroethylene	0.005 mg/l

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The selected remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e. reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c), a statutory review by EPA will be conducted no less often than every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary of this ROD. Additional information can be found in the Administrative Record file for this Site.

ROD AMENDMENT CERTIFICATION CHECKLIST	
Information	**Location/Page number**
Chemicals of Concern and respective concentrations RAGS D "Table 10's"	Pages 22 -29
Baseline risk	Summary of Site Risks / Page19
Cleanup levels and the basis for these levels Performance Standards	Page58
How source materials constituting principal threats are addressed	Principal Threat Wastes / Page 52
Current and reasonably anticipated future land use and potential future beneficial uses of groundwater	Current and Potential Land and Resource Uses / Page 17
Potential future groundwater use that will be available at the Site as a result of the Selected Remedy	Current and Potential Land and Resource Uses / Page 17
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Page 51
Key factors that led to selecting the remedy	Summary of the Rationale for the Selected Remedy / Page 52

Abraham Ferdas, Director
Hazardous Site Cleanup Division
EPA Region III

9/28/01
Date

CROSSLEY FARM SUPERFUND SITE
HEREFORD AND WASHINGTON TOWNSHIPS, BERKS COUNTY, PENNSYLVANIA

RECORD of DECISION

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RECORD OF DECISION

CROSSLEY FARM SUPERFUND SITE

PART II - DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

The Crossley Farm Site is located in a rural area approximately 7 miles southwest of Allentown in the Huffs Church community of Hereford Township, Berks County, Pennsylvania. The site is located along the southern side of Huffs Church Road, approximately 3 miles west-northwest of State Route 100 and northwest of the borough of Bally. The Site location is shown on Figure 1.

The Site is located in the Reading Prong Physiographic Province. The topography reflects the complex underlying bedrock geology and consists of high hills and ridges underlain by bedrock. The most prominent highland within the study area occurs at the Site and is known locally as Blackhead Hill. The hill is very steeply sloped to the west and south of its crest. To the north and east of its crest, the hill is fairly level or flat and supports a working farm over much of its area. The crest of Blackhead Hill is underlain by the Hardyston Quartzite, which makes an attractive building stone. A small quarry at the crest of the hill has had some limited activity for nearly 50 years.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

From the mid-1960s to the mid-1970s, a local manufacturing plant reportedly sent numerous 55 gallon drums to the Crossley Farm for disposal. These drums contained mostly liquid waste and were described as having a distinctive "solvent" odor. The plant was believed to have used trichloroethylene (TCE) as a degreaser from at least the mid-1960s until 1973 and tetracholorethyne (PCE) from at least the early 1960s until 1980.

Known and alleged waste disposal areas at the Site include a trash dump, the quarry, the borrow pit area, an alleged drum disposal area and the EPIC pit area. All of these suspected source areas were investigated and are further described in the Remedial Investigation / Feasibility Study Report (RI/FS).

State involvement at this Site began in 1983, when local residents complained to the Pennsylvania Department of Environmental Resources (PADER) about odors in private water supply wells. A PADER sampling program of local wells conducted in September 1983 revealed concentrations of TCE as high as 8,500 micrograms/liter (ug/L) and PCE as high as 110 ug/L: The Maximum Contaminant Levels (MCLs) for both TCE and PCE established under the Safe Drinking Water Act are 5 ug/L . A subsequent sampling round conducted by

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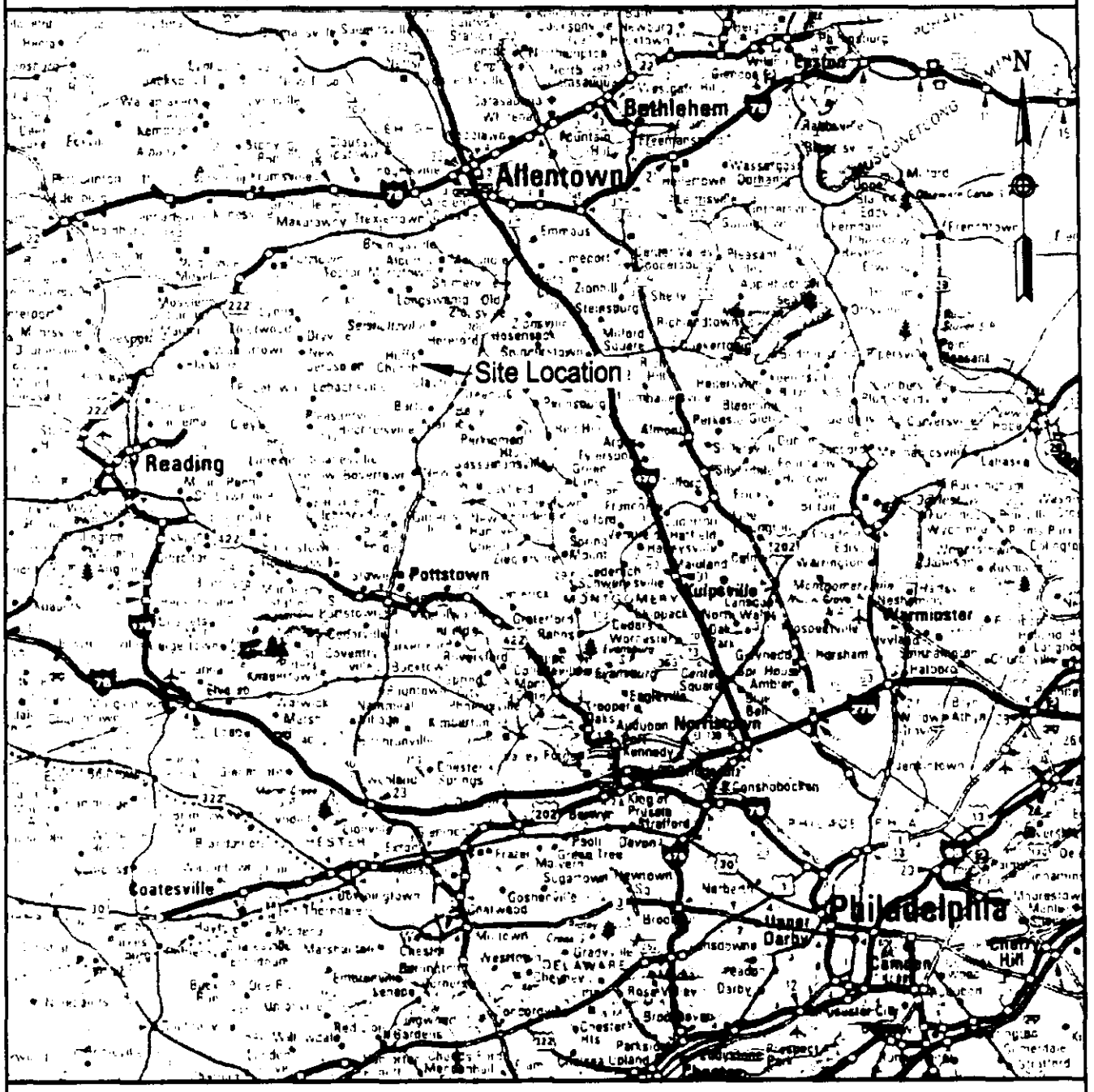

0 6 12

SCALE IN MILES

SITE LOCATION MAP

CROSSLEY FARM

HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 1

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PADER and EPA in November 1983 revealed that eight home wells contained detectable levels of TCE, and in six of these wells the concentrations of TCE exceeded 200 ug/L.

As a result of the November 1983 sampling, PADER issued a health advisory on groundwater use in the area and recommended either boiling water, installing carbon filtration systems, or using bottled water where TCE concentrations exceeded 45 ug/L. Shortly thereafter, a temporary water supply was provided by the Pennsylvania National Guard through the Pennsylvania Emergency Management Agency. This supply was terminated in mid-1985.

After the health advisory was issued, local residents began to voice concerns about Crossley Farm and alleged dumping of wastes there. In response to these concerns, EPA conducted a Preliminary Assessment (PA) of the property. The PA, completed in June 1984, concluded that insufficient information existed to identify the source of the groundwater contamination and suggested that a regional groundwater study be conducted.

Further citizen complaints in August 1986 prompted additional sampling of residential wells by EPA in September 1986. TCE levels detected during these rounds ranged up to 19,000 ug/L. Additional well sampling in November 1986 detected TCE at a maximum level of 22,857 ug/L.

EPA initiated an removal action in December 1986 and, in January 1987, EPA began installing carbon filtration units on the most severely impacted private wells. A contaminant concentration level of 180 ug/L of TCE or greater was used as the criterion for installing a filter for any particular well. This criterion was developed in consultation with the Agency for Toxic Substances and Disease Registry (ATSDR) and was based on one-half of the Drinking Water Equivalent Level (DWEL). At that time15, carbon filter units were installed and maintained by EPA.

In the spring of 1987, EPA initiated a regional hydrogeological investigation to include the installation and sampling of on-site and off-site monitoring wells and the sampling of residential well supplies. This investigation, completed in August 1988, concluded that the source of the TCE in the groundwater was near the crest of Blackhead Hill. The abandoned quarry and the borrow pit area were cited as the presumed source areas. The investigation delineated a contaminated groundwater plume extending approximately 7,000 feet downgradient from Blackhead Hill and along Dale Road.

Concurrent with and independent of the EPA study, residential wells near Dale Road were sampled and analyzed for polychlorinated biphenyls (PCBs) and other contaminants as part of a PADEP investigation of the Texas Eastern - Bechtelsville compressor station. One residential well located on Forgedale Road contained TCE at levels greater than 200 ug/L, suggesting that the TCE plume associated with the Crossley Farm Site extended even farther to the south than mapped, since TCE was determined not to be a common waste product from compressor station operations. This result prompted additional sampling by EPA along Forgedale Road, south to Old Route 100, as part of the Crossley Farm investigation. These analytical data indicated that

the plume extended south of the compressor station and Forgedale Road and about 9,000 feet downgradient from Blackhead Hill.

In February 1991, EPA issued the final Hazard Ranking System (HRS) package for the Crossley Farm Site in preparation for the Site's proposal for the National Priorities List (NPL). In July 1991, the site was proposed for the NPL. The Site was formally listed on the NPL in October, 1992.

In September 1994, EPA initiated a RI/FS for the Site to evaluate existing data, collect additional data as necessary and consider appropriate actions. EPA decided to expedite the evaluation of alternatives to address the contaminated residential well supply problem by preparing a Focused Feasibility Study (FFS) prior to completion of the remaining Site investigation activities.

In June 1997, EPA signed a Record of Decision to provide point of entry carbon treatment units for all residential drinking water wells that showed contamination related to the Site. This was considered the first operable unit (OU1) for the remedial action at the Site. EPA's subcontractor, S&G Water Conditioning, began the installations in September 1999. To date, EPA has installed a total of forty-three carbon treatment systems in area homes impacted by the Site contamination.

The remedial action for OU1 is complete and the Pennsylvania Department of Environmental Protection (PADEP) assumed the responsibility for maintaining these systems beginning in February 2001. EPA will continue to sample drinking water wells in the area of the Site every six months to determine whether any new homes require a carbon treatment system.

In the summer of 1998, EPA's Removal Program excavated approximately 1200 drums and 15,000 tons of contaminated soil from the location identified as the Epic Pit Area. All of these materials were disposed at approved and permitted hazardous waste disposal facilities.

The field activities continued through 1999 and the RI/FS reports were completed in July 2001.

The Site is approximately 209 acres of land which consists of several parcels owned by the Crossley Brothers Partnership, the estate of Harry Crossley and Ruth Crossley. The Site has been operated as a dairy farm since 1927, either by members of the Crossley family, or by the local farmer currently renting the Site property. There has never been a permitted hazardous waste facility at the Site and no regulatory permits have ever been issued to the Crossley Brother Partnership, Harry Crossley or Ruth Crossley.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The documents which EPA used to develop, evaluate, and select a remedy for the Site have been maintained at the Hereford Township Municipal Building, 3131 Seisholtzville Road, Macungie,

PA, the Washington Township Municipal Building, 120 Barto Road, Barto, PA and at the EPA Region III Office, Philadelphia, PA.

The Proposed Plan was made available to the public on July 23, 2001. The notice of availability for the RI/FS and Proposed Plan was published in The Reading Eagle, The Boyertown Times and the Harthstone Country Town and Press on August 2, 2001. The public comment period began on July 23, 2001 and was extended until August 30, 2001.

At the August 7, 2001 public meeting, representatives from EPA answered questions about the Site and the remedial alternatives under consideration. Approximately 50 people attended the meeting, including residents from the impacted area and news media representatives. A summary of comments received during the comment period and EPA's responses are contained in Part III of this document.

Another meeting was held on August 21, 2001 at the request of the Hereford Township Supervisors to coincide with their regularly scheduled Supervisors meeting and an EPA representative presented the proposed clean up alternative and answered questions. A summary of these comments is also contained in Part III of this document.

EPA has met with the current landowners and their counsel in order to obtain an understanding of the anticipated future land use, which are discussed in the "Current and Potential Future Land and Resource Uses" section of this ROD.

The actions discussed above fulfill the public notification requirements of Sections 113(k)(2)(B), 117(a), and 121(f)(1)(G) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. §§ 9613(k)(2)(B), 9617(a), and 9621(f)(1)(G) (also known as "Superfund") and the general requirements of the National Oil and Hazardous Substances Contingency Plan ("NCP"), 40 CFR Section 300.430(f)(2).

IV. SCOPE AND ROLE OF RESPONSE ACTIONS

As discussed in the Site History section, the Crossley Farm Site has been known to have groundwater contamination since the early 1980's. EPA's initial actions provided carbon filtration units for a limited number of homeowners and began the regional groundwater investigation. Following the addition of the Site to the National Priorities List, the Agency began the work plan and field activities which lead to the discovery of the buried drums in the Epic Pit area. EPA mobilized a response action to remove the drums and contaminated soil which was one of the source areas for groundwater contamination.

At the same time EPA decided to review the analytical results from all the residential drinking water wells and to provide carbon filtration systems to all homeowners who had contaminants in their water related to the Site contamination. These units have been installed by EPA and are now maintained by PADEP.

This remedy is proposed as an interim action to begin the massive and complex task of cleaning up the groundwater contamination problem originating at the top of Blackhead Hill with concentrations as high as 190,000 ug/l. This action will address only the "hot spot" located in the borrow pit area and will be used to measure and define the ability of a groundwater extraction and treatment system to reduce the highest concentration of contaminants.

This interim remedial action is not a final decision on the regional groundwater cleanup. If extraction and treatment in the "hot spot" is successful in reducing concentrations at the top of the hill and in the springs located on the hill and in the valley, the proposed remedy can be expanded through a separate EPA decision document to become a larger network of extraction wells to remove more contaminated groundwater from the fractured bedrock.

This remedial action is only for groundwater. The evaluation of the soil did not show remaining soil concentrations which would impact the already contaminated groundwater. The evaluation of surface water shows elevated concentration in the discharge of several springs, but the treatment of groundwater should reduce the concentration in the springs. The sediment evaluation did not show any excessive risks for human health or wildlife in the vicinity of the Site.

This remedy is for a second operable unit (OU2) to treat groundwater. The first operable unit for point of entry treatment to residential drinking water supplies at the impacted residences will remain in effect. .

V. SUMMARY OF SITE CHARACTERISTICS

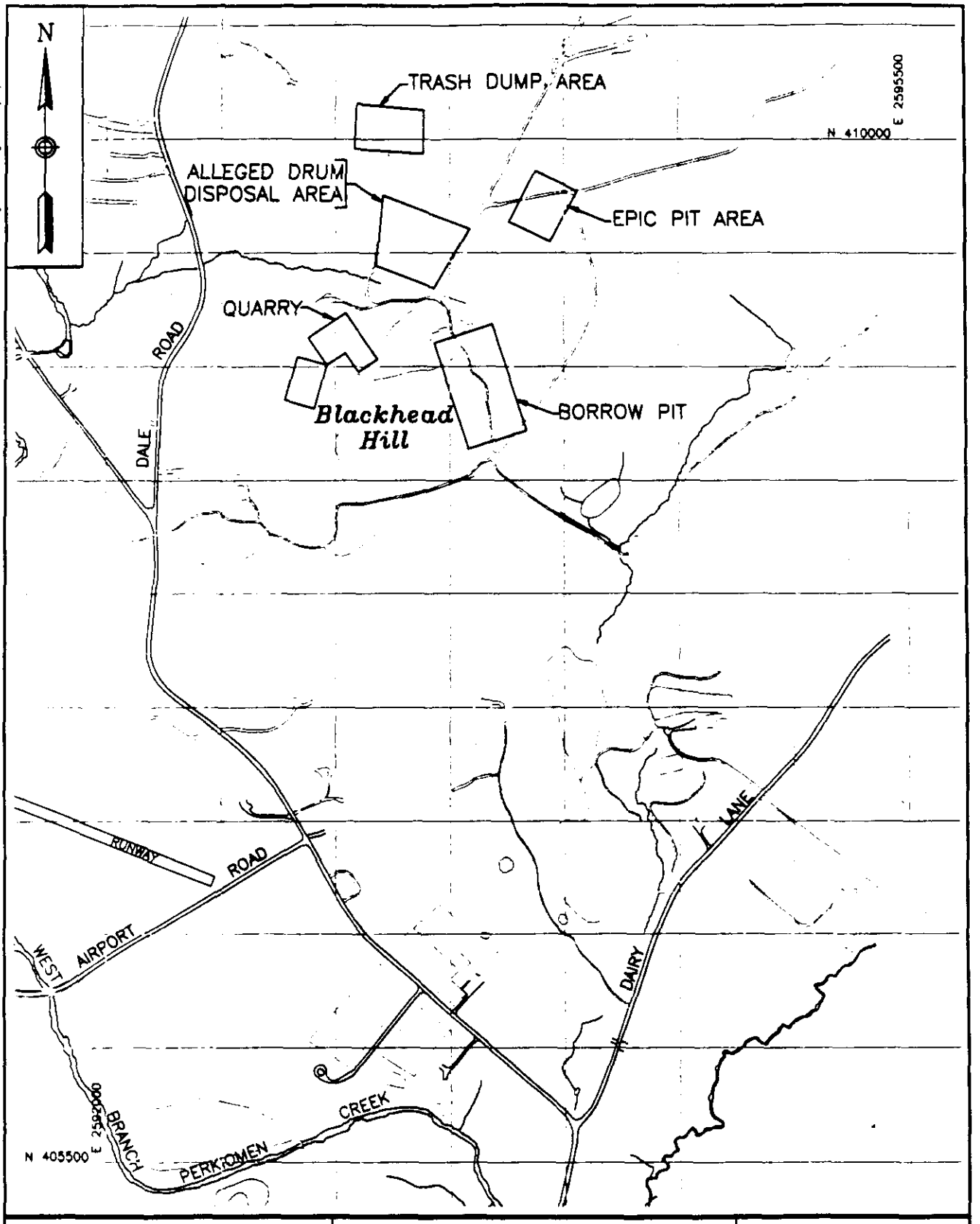
Site description

The Remedial Investigation field activities for the Site began in October 1996. The initial area for the investigation was the actual farm property located on the top of Blackhead Hill on the southern side of Huff's Church Road. The files identified several potential source areas. Each of these areas has been named and identified on the Site map Figure 2.

The Trash Dump "Dump"consists of mainly household and farm related trash.

The Quarry is on the crest of Blackhead Hill and was previously cut and blasted to break up the boulders and fractured bedrock into smaller stones used for building materials. It is suspected that unregulated disposal of solvent waste liquids were poured over the exposed rock and migrated quickly into the fractured bedrock aquifer.

The Borrow Pit Area is located on the eastern side of the quarry. Approximately 8 -12 feet of soil was excavated to the top of the bedrock. It is suspected that the borrow pit area was previously used as a staging / storage area for drums of waste material.



POTENTIAL SOURCE AREAS

CROSSLEY FARM

HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 2

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The Alleged Drum Disposal Area is a portion of the farm field that had been identified by previous discussions with local residents as the location of buried drums. However, based on the Remedial Investigation this area is not a source area and no drums were found.

The EPIC Pit Area was identified by a 1980 aerial photograph which noted possible disposal activity. At the beginning of the field investigation, this area was utilized for crops the same manner as the other open areas of the farm. During the geophysical investigation and soil gas investigation, the EPIC Pit Area was identified as the actual location of the buried drums. EPA prepared an Action Memorandum and the pit was excavated by the Emergency Response Team in the summer of 1998 resulting in the removal of approximately 1200 drums and 15,000 tons of contaminated soil.

In addition to the farm property on the top of Black head Hill, the Remedial Investigation expanded the Crossley Farm Site to include the groundwater originating at the top of the hill and flowing in a southerly direction down the valley towards Dale Road, Dairy Lane and then towards Forge Dale Road. The groundwater investigation identified contamination from the industrial solvents TCE and PCE. Contamination has been detected in residential home wells and monitoring wells at various depths. The contaminated groundwater plume extends almost 3 miles down the valley from Blackhead Hill.

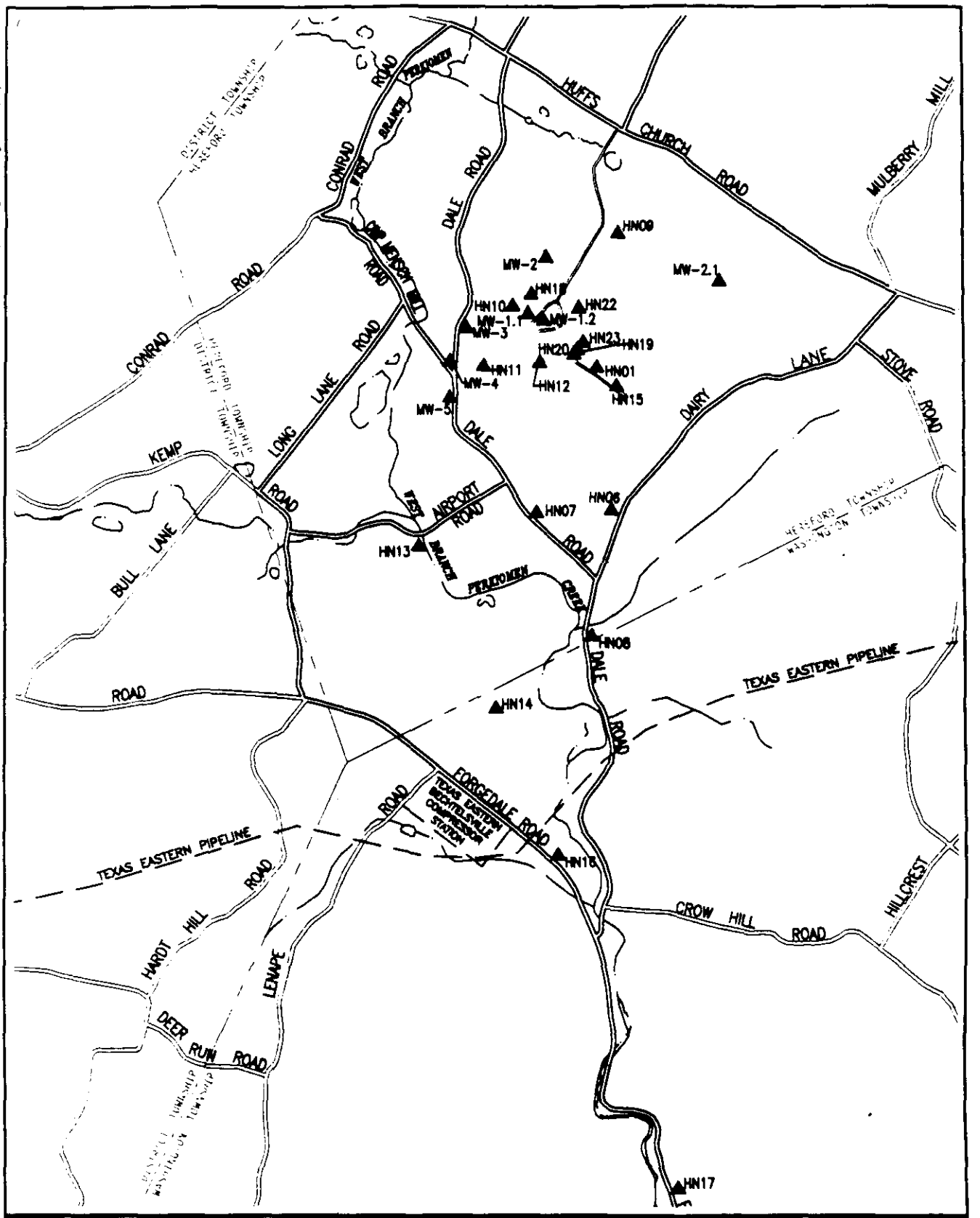
Groundwater

A total of 39 monitoring wells were installed during the field investigation to delineate the nature and extent of contamination associated with the Site. The wells were located on the farm property at the top of Blackhead Hill as well as down the hill adjacent to the farm and also down the valley along Dale Road, Airport Road and Forge Dale Road. The locations are shown on Figure 3. Each location has one or more wells in clusters to provide samples from different depths.

The RI report shows concentrations of TCE at three depths; shallow (approximately 40 - 70 feet deep), intermediate (100 - 150 feet deep) and deep (200 - 400 feet deep). Each map shows color contours indicating concentrations in micrograms per liter (ug/l) which is the standard unit for laboratory analysis of water samples. One ug/l is equivalent to one part per billion or 1 ppb.

The groundwater maps range from 10 ug/l (10^1) up to 100,000 ug/l (10^5). The highest concentration was 190,000 ug/l at well HN-23 which is located at the top of the hill in the Borrow Pit Area. This is a very high concentration. For reference, the drinking water standard is only 5 ug/l. It is suspected that the TCE may still be in pure product form which is referred to as a Dense NonAqueous Phase Liquid ("DNAPL").

Figure 4 shows the data for TCE concentrations in groundwater from the intermediate depth at the top of the hill and Figure 5 illustrates TCE concentrations in the deeper groundwater zone for the entire valley plume.


1340/7525gm01.dwg 6/1/01 LDL
CONRAD ROAD
FIRST PERKIOMEN BRANCH
DALE ROAD
HUFFS CHURCH ROAD
MULBERRY MILL
OLD MACUNGIE ROAD
LONG LANE ROAD
KEMP ROAD
BULL LANE
WEST AIRPORT ROAD
PERKIOMEN BRANCH CREEK
DAIRY LANE
STOVE ROAD
TEXAS EASTERN PIPELINE
FORGEDALE ROAD
TEXAS EASTERN MAGNOLIA COMPRESSOR STATION
CROW HILL ROAD
HILLCREST
HARDT HILL ROAD
LENAPE
DEER RUN ROAD
HEREFORD TOWNSHIP
WASHINGTON TOWNSHIP
MW-1.1
MW-1.2
MW-2
MW-2.1
MW-3
MW-4
MW-5
HN01
HN06
HN07
HN08
HN09
HN10
HN11
HN12
HN13
HN14
HN15
HN16
HN17
HN18
HN19
HN20
HN22
HN23
0
1800
3600
SCALE IN FEET
LOCATIONS OF
MONITORING WELL CLUSTERS
AT
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA
FIGURE 3
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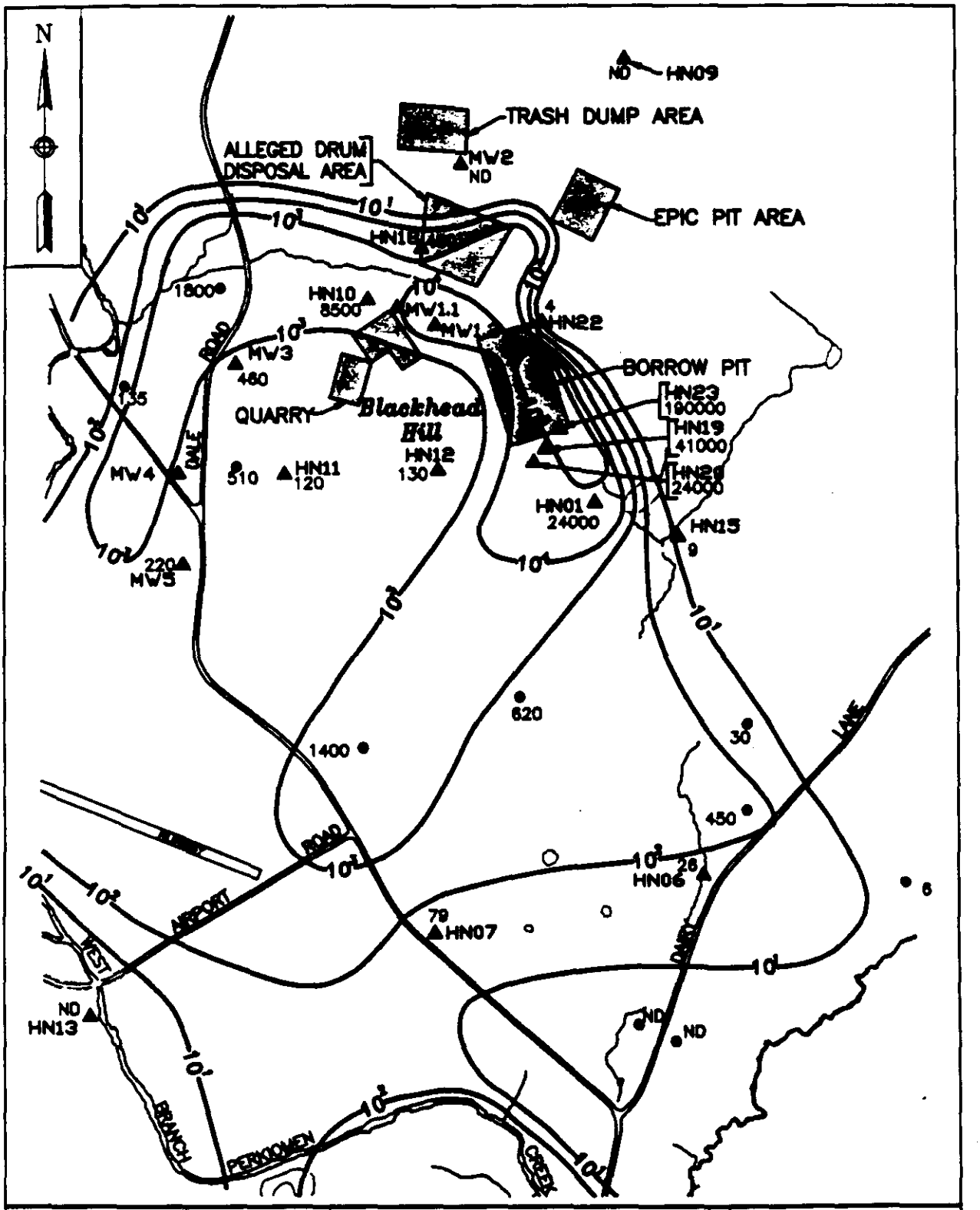

NOTE:
TCE CONCENTRATIONS REPORTED IN ug/L

0 600 1200
SCALE IN FEET

TCE CONCENTRATIONS IN INTERMEDIATE GROUNDWATER

CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 4

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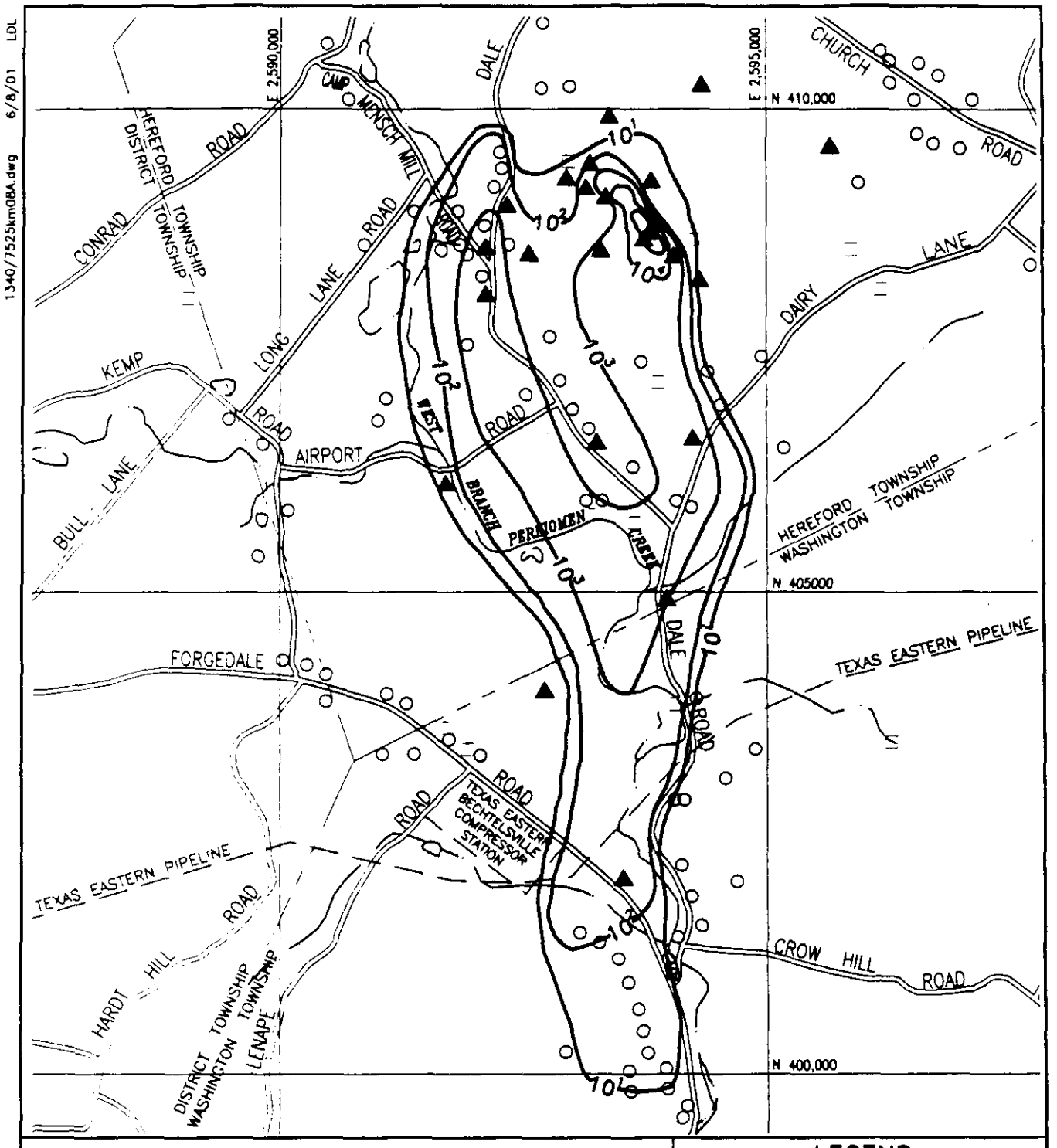

NOTE:

TCE CONCENTRATIONS REPORTED IN µg/L.

LEGEND

▲ = MONITORING WELL LOCATION

○ = RESIDENTIAL WELL LOCATION

0 1500 3000

SCALE IN FEET

TCE CONCENTRATIONS
IN
DEEP GROUNDWATER
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 5

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The groundwater sampling and analysis for inorganic compounds indicates that a number of naturally occurring metals were detected throughout the study area. The only ones which have been identified in the baseline risk assessment are lead, iron and manganese because the concentrations in the center of the plume area exceed the Region III risk based concentrations (RBCs). The lead is attributable to the local geology and not from any disposal activities. The manganese and iron are also attributed to the local geology, but they can be leached from the soil and rock due to the contamination in the groundwater and are considered attributable to the Site.

Surface Water and Springs

As shown in Figure 6, a total of 21 locations were sampled for the RI field activities. The results indicate that the contamination is fairly widespread throughout the study area. This is a result of the shallow groundwater discharge through springs to surface water and the general flow toward the West Branch of the Perkiomen Creek.

The highest concentrations found were located at four spring locations; SW-11, SW-10, SW-13 and SW-15. Based on the latest sampling information, these springs are discharging groundwater at concentrations around 200 ug/l of TCE.

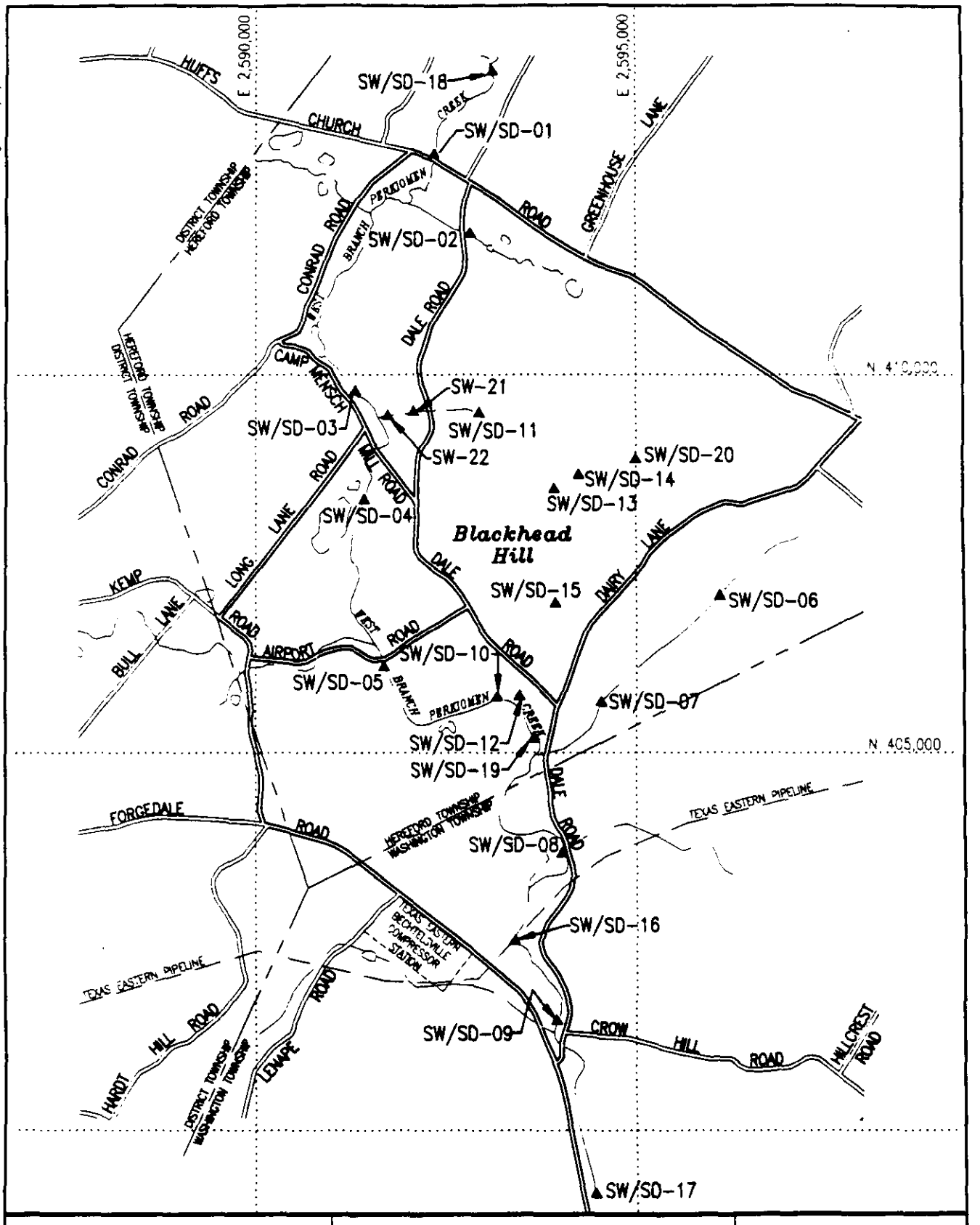
The samples taken from the creek show a decrease in concentration to around 10 - 20 ug/l because of the dilution when entering the larger flow volume in the creek.

There is a very positive finding in the results over time in the hottest spring, SW-11. When the Round 1 sample was taken in 1997, the concentration of TCE was over 2000 ug/l. By the June 2000 Round 4 sampling the concentration decreased to around 200 ug/l. This decrease appears to be directly attributable to the Removal Action taken in 1998 where over 1200 drums and contaminated soil were excavated from the EPIC Pit Area that is directly upgradient from spring SW-11.

The inorganic analysis for the surface water throughout the study area includes aluminum, arsenic, barium, iron, manganese, thallium, beryllium, cyanide, chromium, lead and zinc. Because minerals are a natural component of surface water, the RI attempted to determine if any of these metals could be attributed to the Site. The RI indicated that cyanide is the only metal that may be attributed to the site because it appears in three of the springs immediately downgradient of the disposal area. However the levels do not generate a risk to the public or the environment.

Sediments

Overall, the nature and extent of the VOC contaminants within the sediments is very similar to the results for surface water. The springs at SD-11 and SD-10 present the highest concentration of TCE at 6240 ug/kg and 116 ug/kg respectively. The concentration of TCE in the springs at


1340-7525km01.dwg 6/5/01 LDL
E 2,590,000
E 2,595,000
N 410,000
N 405,000
HUFFS CHURCH ROAD
SW/SD-18
SW/SD-01
PERKIOMEN CREEK
GREENHOUSE LANE
DISTRICT TOWNSHIP HEREFORD TOWNSHIP
CONRAD ROAD
PERKIOMEN BRANCH
SW/SD-02
DALE ROAD
CAMP MENSCH ROAD
SW-21
SW/SD-11
SW/SD-03
SW-22
SW/SD-20
SW/SD-14
SW/SD-13
MILL ROAD
SW/SD-04
Blackhead Hill
LONG LANE
KEMP ROAD
BULL LANE
AIRPORT ROAD
SW/SD-15
DAIRY LANE
SW/SD-06
SW/SD-10
SW/SD-05
SW/SD-07
SW/SD-12
SW/SD-19
FORGEDALE ROAD
HEREFORD TOWNSHIP WASHINGTON TOWNSHIP
TEXAS EASTERN PIPELINE
SW/SD-08
TEXAS EASTERN BECHTELSVILLE COMPRESSOR STATION
SW/SD-16
HARDT HILL ROAD
LENAPE ROAD
SW/SD-09
CROW HILL ROAD
HILLCREST ROAD
SW/SD-17
0 1800 3600
SCALE IN FEET
SURFACE WATER & SEDIMENT
SAMPLING LOCATIONS
CROSSLEY FARM SITE
HEREFORD TOWNSHIP, BERKS COUNTY, PA
FIGURE 6
1340-7525km01.dwg

AR302272

SD-13 and SD-15 are lower at less than 5 mg/kg. One sample taken at SD-8 indicates a concentration of TCE at 86 mg/kg which was higher than expected based on the surface water sample results.

Four sampling locations (SD-2, SD-8, SD-10 and SD-12) contain the maximum inorganic concentrations of iron, manganese, aluminum, arsenic, nickel, thallium and zinc. The majority of the metals found in sediment are naturally occurring and ubiquitous throughout the Site.

Soil

The soils evaluation was subdivided into three categories and the results are presented in Section 4 of the RI for the surface soil, the subsurface soil and the test pit (Trash Dump) location. Figure 7 shows the location of the source investigation areas.

Volatile organics, specifically TCE, were only detected in two samples near the Borrow Pit. Both concentrations were below 10 ug/kg. This supports the assumption that the area was previously used for disposal, but the low concentrations found indicate that the bulk of the contaminated soil was removed. The small amount of contaminated soil that remains is not be a residual source of contamination for the underlying groundwater in the bedrock.

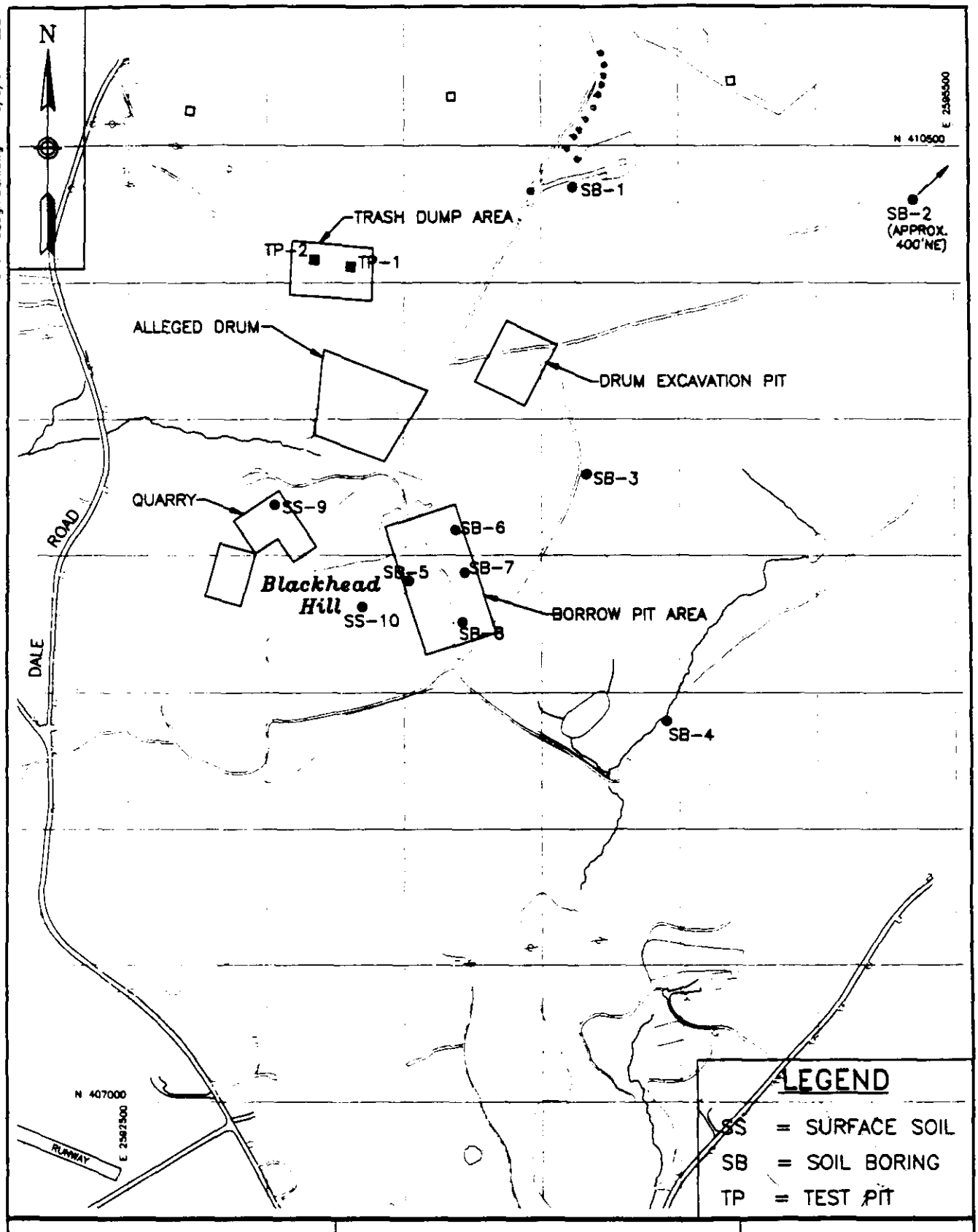
There was also one detection of TCE in the Trash Dump area at 18 ug/kg which appears to be an isolated occurrence and only in small quantities. The dump is also not considered a major contributor to the contaminated groundwater plume.

The inorganic analysis for soil indicated that the metals of concern included aluminum, chromium, iron, manganese and vanadium for the surface and subsurface soils. Analysis of the Trash Dump area revealed these same metals plus arsenic and thallium. These metals occur naturally and the distribution throughout the Site does not support the conclusion that any elevated concentrations of metals were a result of unregulated disposal of hazardous waste solvents at the Site.

One type of PCB was detected at three different locations in the soil on the farm. Aroclor - 1260 was detected near the Trash Dump, the Borrow Pit and the Quarry Area. The concentrations ranged from 40 ug/kg to 1000 ug/kg.

Residential Well Sampling

Figure 8 shows the large area covered by the residential well sampling. The results of the first five rounds of sampling are provided in Appendix H in Volume II of the RI report. EPA has monitored the individual wells and springs over the past four years and the homeowner's results were sent directly to each residence. Only well numbers were used to identify samples in Appendix H to protect the identity of homeowners. EPA will continue to sample drinking water



SOIL SAMPLE LOCATION MAP

CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 7

1340-7525gm20A.dwg 6/6/01 LDL

1340-7525gm20A.dwg

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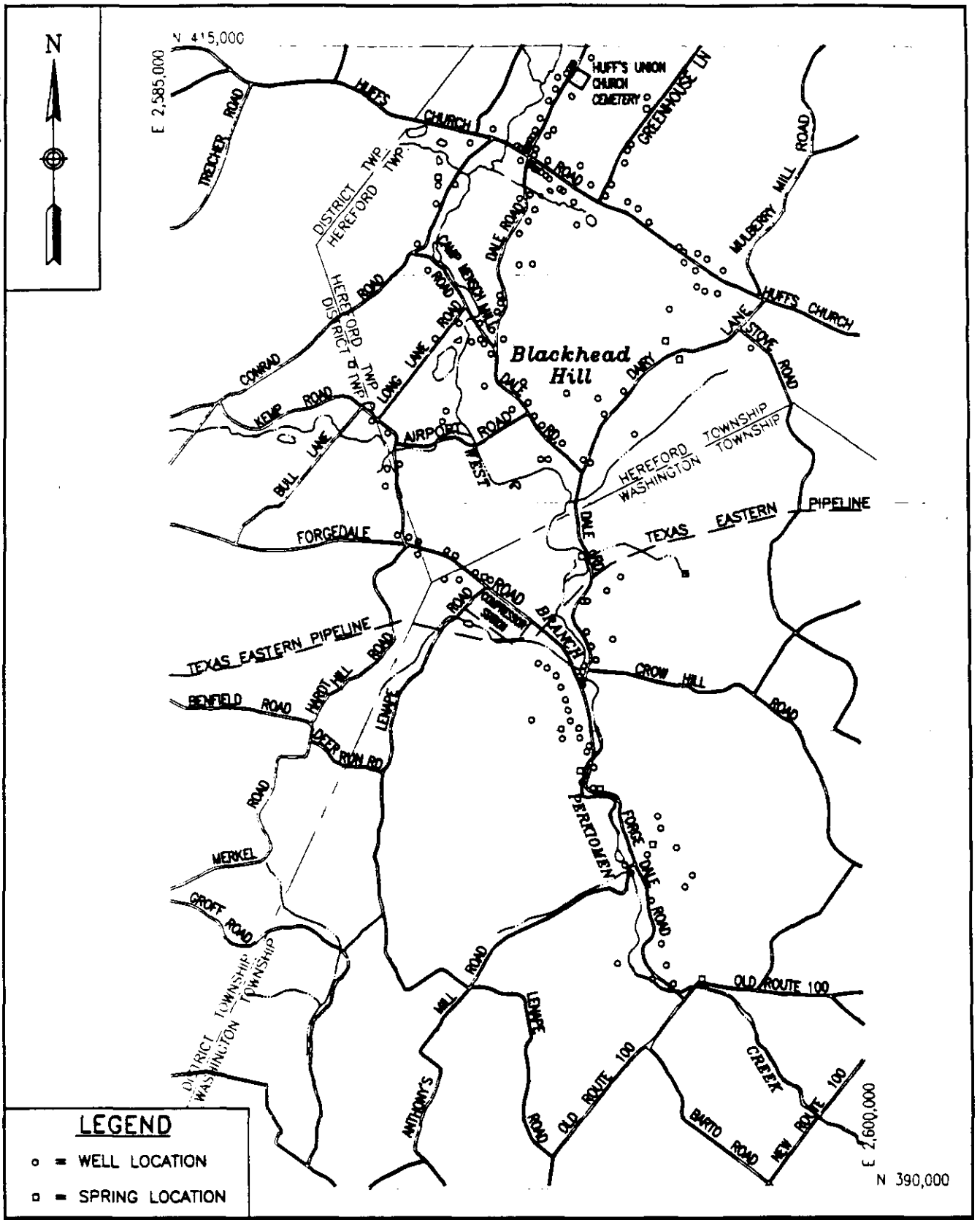
N
N 415,000
E 2,585,000
HUFF'S UNION CHURCH CEMETERY
HUFF'S CHURCH ROAD
GREENHOUSE LN
MULBERRY MILL ROAD
TRECHER ROAD
DISTRICT TWP
HEREFORD TWP
DALE ROAD
CAMP MEDIN MEN
HEREFORD DISTRICT TWP
CONRAD
KEMP ROAD
LONG LANE
Blackhead Hill
DAIRY LANE
STONE ROAD
BULL LANE
AIRPORT ROAD
WEST
HEREFORD WASHINGTON TOWNSHIP
FORGEDALE
TEXAS EASTERN PIPELINE
BRANCH
CROW HILL ROAD
BENFIELD ROAD
HARDT HILL ROAD
LEWIS
DEER RUN RD
MERKEL
GROFT ROAD
PERKIOMEN
FORGE DALE ROAD
OLD ROUTE 100
MILL
LEWIS
ANTHONY'S
CREEK
BARTO ROAD
NEW ROUTE 100
E 2,600,000
N 390,000
LEGEND
o = WELL LOCATION
□ = SPRING LOCATION
0
3000
6000
SCALE IN FEET
LOCATIONS OF
RESIDENTIAL WELLS & SPRINGS
AT
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA
FIGURE 8
1340-7525cm01.dwg 6/6/01 LDL
1340-7525cm01.dwg

AR302275

wells in the area of the Site, every six months, to determine whether any additional carbon treatment systems are needed for the current existing homes.

The current point of entry treatment systems established as the interim remedy for drinking water in OU 1 will remain in effect for existing homes and will not be changed by this remedy for the groundwater remedial action. EPA will continue to monitor the individual wells and springs as outlined in the 1997 Record of Decision for OU 1.

Conceptual Site Model

The risk assessment and response actions for this Site are based on the groundwater medium and the potential exposures to people living or working in the area where the groundwater contamination exists. The exposure scenarios and pathways are further described in the summary of risks section.

VI. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The area where disposal occurred on the Site is currently used for a dairy farm and feed stocks are grown on the available farming land. It is expected that the property will remain a farm in the future. The farm activities will not interfere or minimize the scope of the remedial action because the area required for construction of the groundwater treatment facility will be placed over the hot spot area at the top of the hill in the borrow pit area and the adjacent wooded areas. The exact dimensions of the treatment area will be defined in the Remedial Design and it is expected that an easement will be used to assure that the property will be available for the remedial action.

The extended area of the groundwater plume is currently both residential and farm land. The future use is also expected to be residential and farming, but over time the number of residential properties is expected to increase with new construction based on comments received during the public comment period and discussions with local township managers and supervisors.

The current groundwater contamination is monitored by EPA by taking samples from the residential wells in the area and this activity will continue under this Record of Decision and future remedial actions.

The current homeowners who have any detections of contamination from the Site have been provided in home treatment systems at the point of entry for their water consumption and use.

If the groundwater monitoring program finds that any of the existing homes have become contaminated above the drinking water standards for cis-1,2-dichloroethylene, tetrachloroethylene or trichloroethylene, EPA will install a treatment unit in the home and will maintain the unit for the first year to assure that it is working properly. Following the first year,

maintenance will be the responsibility of the Pennsylvania Department of Environmental Protection.

For the purpose of this ROD, "existing home" means any residence which has received a local building permit prior to March 1, 2001; most but not all of these homes are identified in Appendix H of the RI report for this operable unit.

Any new construction in the area above the groundwater contamination plume will be responsible for the analysis of the groundwater and treatment if needed to meet the drinking water standards.

VII. SUMMARY OF SITE RISKS

Baseline Human Health Risk Assessment

The baseline risk assessment (RA) estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this Site.

The risk assessment performed during the RI/FS identified groundwater contamination beneath and beyond the boundaries of the Site as posing an unacceptable level of risk.

The **National Contingency Plan ("NCP"), 40 CFR** Part 300, establishes a range of acceptable levels of carcinogenic risk for Superfund sites that range between one in 10,000 and one in 1 million additional cancer cases if cleanup action is not taken at a site. Expressed in **scientific notation**, this translates to an acceptable risk range of between 1E-04 (1 X 10-4) and 1E-06 (1 X 10^{-6}) over a defined period of exposure to site related contaminants.

In addition to carcinogenic risk, chemical contaminants that are ingested, inhaled or dermally absorbed may present non-carcinogenic risks to different organs of the human body. The non-carcinogenic risks or toxic effect are expressed as a **Hazard Index ("HI")**. EPA considers a HI exceeding one to be an unacceptable non-carcinogenic risk.

Identification of Contaminants of Concern

Contaminants of concern ("COCs") for each medium and exposure pathways were selected based on a variety of criteria. COCs are selected based on both their carcinogenic and non-carcinogenic toxicity. For this ROD, only the most significant COCs (i.e., contaminants significantly greater than background that contribute to total cancer risks greater than 1E-04 or a non-cancer hazard index greater than 1) are presented in the "Table 10s" attached. Please note that these tables reflect some minor changes since they were originally placed in the Administrative Record in July 2001.

In December of 1997, EPA implemented the Risk Assessment Guidance for Superfund (RAGS) Volume 1 -Human Health Evaluation Manual (Part D, Standardized Planning Reporting and Review of Superfund Risk Assessments); now known as "RAGS D".

One of the objectives was to have standard tools to document the planning , reporting and review of human health risk assessments in a consistent format, to clarify assumptions made, and to increase a readers ability to understand the approach followed.

The following tables are known as the "Table 10's" which provide a summary for each receptor by medium, exposure route and exposure point of cancer risks and non-cancer hazards for COCs

that trigger need for cleanup.

The information documented in these tables include:

The cancer risk and non-cancer hazard to each receptor for each COC. by exposure route and exposure point.

The total cancer risk and non-cancer hazard for each exposure pathway for risk drivers.

The cancer risk and non-cancer hazard for each medium across all exposure routes for risk drivers

The primary target organs for non-carcinogenic hazard effects.

Exposure Assessment

The RA studies the carcinogenic and non-carcinogenic, current and future risks at the Site based on the levels of contaminants found during the RI and reasonable risks were calculated based on chemicals of concern ("COCs") from groundwater, surface water, sediments and soil. The risk assessment also evaluated the pathway which could lead to exposure for people such as drinking the water, wading or swimming in the springs, eating fish, direct contact or ingestion of the soil and the possibility of an agricultural pathway. The possible human receptors include current and future resident scenarios for children and adults, recreational exposure, and industrial worker and a construction worker.

The risk assessment chapter of the RI report presents a comprehensive description of the details used for the calculations for each of these scenarios, but the most critical information for this ROD is based on the summary of combined risks from all exposure pathways for the resident child, resident adult and the lifetime resident.

Toxicity Assessment

The human health risk assessment in the administrative record provides details of the process and toxicity values for all contaminants detected

Risk Characterization

For a resident child, resident adult and lifetime resident the Reasonable Maximum Exposure . (RME) carcinogenic risks were significantly greater than 1 X 10^{-4} based upon contributions from groundwater . Lifetime risk for surface water slightly exceeded the acceptable cancer risk range due to high levels of TCE/PCE in one spring sample. The risks from other pathways (soil and sediment) were less than 1 X 10^{-4}. The "Table 10s" summarize these risks.

For the residential child, groundwater ingestion was 54 percent of combined cancer risk and dermal contact with groundwater was 46 percent. For the residential adult, groundwater ingestion was 55 percent of combined cancer risk and inhalation during showering with groundwater was 45 percent. For the lifetime resident, groundwater ingestion was 55 percent of combined cancer risk, dermal contact with groundwater was 19 percent and inhalation during showering was 26 percent.

Maximum noncancer risk for the residential child and residential adult were driven by several contaminants in groundwater including volatile organic compounds and iron HIs up to 1030 for groundwater ingestion and HIs up to 1330 for dermal contact for the residential child, and HIs up to 630 for inhalation of vapors during showering and HIs up to 378 for groundwater ingestion for the residential adult. In addition, maximum risks were significant due to contact with test pit soil (around and under the trash dump). Iron in soil contributed the most to an HI 2.74 for a residential child. Swimming and wading exposures to TCE in surface water at SW10 (see figure 6) were also significant, with respective HIs of 3.38 and 1.76 for the residential child and 2.02 and 1.02 for the residential adult.

The maximum risks for exposure to all media for the resident child, resident adult and lifetime resident are shown on the following Table 1.

TABLE1

	Risk Type:	NON-CANCER RISK		CANCER RISK
	Receptor:	CHILD	ADULT	LIFETIME RESIDENT
MEDIA	Reference:	Table 10.5 RME	Table 10.6 RME	Table 10.7 RME
Groundwater		2.35E+03	1.01E+03	4.95E-02
Sediment		2.00E-01	8.39E-02	7.68E-07
Surface Water		5.34E+00	3.08E+00	1.21E-04
Test Pit Soil		2.4E+00	6.04E-01	4.53E-05
All Exposure Routes		2.36E+03	1.01E+03	4.97E-02

TABLE 10 (RAGs D 10 5 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - CHILD RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe Future
Receptor Population Resident
Receptor Age Child (age 1-6)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing & Der) with Groundwater (Center of Plume)											
			Iron	--	--	--	--	Iron**	Liver/Blood/GI Tract	7 83E+00	--	1 41E-02	7 84E+00
			1,1,2-Trichloroethane	4 11E-04	--	2 32E-05	4 35E-04	1,1,2-Trichloroethane		2 11E+01	--	1 19E+00	2 22E+01
			1,1-Dichloroethene	3 56E-03	--	2 95E-04	3 86E-03	1,1-Dichloroethene	Liver	7 70E+00	--	6 38E-01	8 34E+00
			1,2-Dichloroethane	5 41E-04	--	1 50E-05	5 56E-04	1,2-Dichloroethane	CNS/Thymus/GI Tract	2 31E+00	--	6 43E-02	2 37E+00
			1,2-Dichloroethene (Total)	--	--	--	--	1,2-Dichloroethene (Total)	Liver	8 68E+00	--	4 50E-01	9 14E+00
			Benzene	3 27E-04	--	1 63E-04	4 89E-04	Benzene	Blood/Immune	2 31E+01	--	1 15E+01	3 46E+01
			Carbon Tetrachloride	8 88E-04	--	1 51E-04	1 04E-03	Carbon Tetrachloride		1 14E+02	--	1 94E+01	1 33E+02
			Chloroform	3 90E-05	--	3 09E-05	6 99E-05	Chloroform	Liver	7 45E+00	--	5 90E+00	1 33E+01
			Tetrachloroethene	5 31E-04	--	1 66E-03	2 19E-03	Tetrachloroethene	Liver	1 19E+01	--	3 72E+01	4 91E+01
			Trichloroethene	4 66E-03	--	7 05E-03	1 17E-02	Trichloroethene	Liver/Kidney	8 23E+02	--	1 25E+03	2 07E+03
			(Total)***	1 10E-02	--	9 39E-03	2 03E-02	(Total)***		1 03E+03	--	1 33E+03	2 35E+03
Surface Water	Surface Water	Contact (Ing & Der) with Surface Water (SW10) During Swimming Activities											
			Tetrachloroethene	1 32E-09	--	3 15E-08	3 15E-08	Tetrachloroethene	Liver	2 96E-05	--	7 08E-02	7 08E-02
			Trichloroethene	1 51E-08	--	1 87E-05	1 87E-05	Trichloroethene	Liver/Kidney	2 66E-03	--	3 31E+00	3 31E+00
			(Total)***	1 64E-08	--	2 19E-05	2 19E-05	(Total)***		2 69E-03	--	3 38E+00	3 38E+00
Surface Water	Surface Water	Contact (Ing & Der) with Surface Water (SW10) During Wading Activities											
			Tetrachloroethene	5 31E-10	--	1 43E-08	1 43E-08	Tetrachloroethene	Liver	1 19E-05	--	3 21E-02	3 21E-02
			Trichloroethene	6 05E-09	--	9 79E-08	9 80E-08	Trichloroethene	Liver/Kidney	1 07E-03	--	1 73E+00	1 73E+00
			(Total)***	6 59E-09	--	1 12E-05	1 12E-05	(Total)***		1 08E-03	--	1 76E+00	1 76E+00
Surface Water	Animal Tissue	Ingestion of Recreasonally Caught Fish (Perk Crk)											
			Aluminum	--	--	--	--	Aluminum	CNS (Developmental)	4 37E-02	--	--	4 37E-02
			Arsenic	5 16E-06	--	--	5 16E-06	Arsenic	Skin/Vascular	1 34E-01	--	--	1 34E-01
			Barium	--	--	--	--	Barium	Kidney	1 75E-02	--	--	1 75E-02
			(Total)	5 16E-06	--	--	5 16E-06	(Total)		1 95E-01	--	--	1 95E-01
Sediment	Sediment	Contact (Ing & Der) with Sediment (SD10) During Swimming Activities											
			Aluminum	--	--	--	--	Aluminum	CNS (Developmental)	2 06E-03	--	3 30E-03	5 36E-03
			Arsenic	5 60E-06	--	7 77E-06	1 34E-07	Arsenic	Skin/Vascular	1 45E-03	--	2 01E-03	3 47E-03
			Chromium	--	--	--	--	Chromium	Kidney	1 16E-03	--	2 01E-02	2 12E-02
			Iron	--	--	--	--	Iron	Liver/Blood/GI Tract	1 81E-02	--	7 00E-03	2 31E-02
			Manganese	--	--	--	--	Manganese	CNS	2 94E-03	--	3 18E-02	3 48E-02
			(Total)	5 60E-06	--	7 77E-06	1 34E-07	(Total)		2 38E-02	--	6 42E-02	8 79E-02

AR302281

TABLE 10 (RAGs D 10 5 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - CHILD RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child (age 1-6)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Contact (Ing & Der) with Sediment (SD10) During Wading Activities											
			Aluminum	--	--	--	--	Aluminum	CNS (Developmental)	4 12E-03	--	3 30E-03	7 42E-03
			Arsenic	1 12E-07	--	7 77E-08	1 90E-07	Arsenic	Skin/Vascular	2 90E-03	--	2 01E-03	4 92E-03
			Chromium	--	--	--	--	Chromium	Kidney	2 31E-03	--	2 01E-02	2 24E-02
			Iron	--	--	--	--	Iron	Liver/Blood/GI Tract	3 23E-02	--	7 00E-03	3 93E-02
			Manganese	--	--	--	--	Manganese	CNS	5 87E-03	--	3 18E-02	3 77E-02
			(Total)	1 12E-07	--	7 77E-08	1 90E-07	(Total)		4 75E-02	--	6 42E-02	1 12E-01
Test Pit Soil	Test Pit Soil	Contact (Ing & Der) with Test Pit Soil											
			Arsenic	1 32E-05	--	2 01E-07	1 34E-05	Arsenic	Skin/Vascular	3 42E-01	--	5 20E-03	3 48E-01
			Iron	--	--	--	--	Iron	Liver/Blood/GI Tract	1 77E+00	--	8 41E-03	1 78E+00
			Thallium	--	--	--	--	Thallium	Liver	5 88E-01	--	2 79E-03	5 90E-01
			(Total)***	1 32E-05	--	2 01E-07	1 34E-05	(Total)***		2 70E+00	--	1 64E-02	2 72E+00
	Vapors	Ambient VOC Inhalation from Test Pit Soil											
			Benz(a)anthracene	--	--	--	--	Benz(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	--	9 24E-09	--	9 24E-09	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	--	--	--	--	Benzo(b)fluoranthene	N/A	--	--	--	--
			Benzo(k)fluoranthene	--	--	--	--	Benzo(k)fluoranthene	N/A	--	--	--	--
			Carbazole	--	--	--	--	Carbazole	N/A	--	--	--	--
			Chrysene	--	--	--	--	Chrysene	N/A	--	--	--	--
			Dibenz(a,h)anthracene	--	--	--	--	Dibenz(a,h)anthracene	N/A	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	--	--	--	Indeno(1,2,3-cd)pyrene	N/A	--	--	--	--
			(Total)	--	9 24E-09	--	9 24E-09	(Total)		--	--	--	--
	Particulates	Particulate Dust Inhalation from Test Pit Soil											
			Aluminum	--	--	--	--	Aluminum	CNS	--	6 82E-03	--	6 82E-03
			Arsenic	--	2 87E-09	--	2 87E-09	Arsenic	N/A	--	--	--	--
			Chromium	--	6 23E-08	--	6 23E-08	Chromium	Lung	--	5 91E-04	--	5 91E-04
			Iron	--	--	--	--	Iron	N/A	--	--	--	--
			Manganese	--	--	--	--	Manganese	CNS	--	1 76E-02	--	1 76E-02
			Thallium	--	--	--	--	Thallium	N/A	--	--	--	--
			Vanadium	--	--	--	--	Vanadium	N/A	--	--	--	--
			Aroclor-1260	--	5 00E-11	--	5 00E-11	Aroclor-1260	N/A	--	--	--	--
			Benz(a)anthracene	--	--	--	--	Benz(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	--	8 80E-11	--	8 80E-11	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	--	--	--	--	Benzo(b)fluoranthene	N/A	--	--	--	--
			Benzo(k)fluoranthene	--	--	--	--	Benzo(k)fluoranthene	N/A	--	--	--	--
			Carbazole	--	--	--	--	Carbazole	N/A	--	--	--	--
			Chrysene	--	--	--	--	Chrysene	N/A	--	--	--	--
			Dibenz(a,h)anthracene	--	--	--	--	Dibenz(a,h)anthracene	N/A	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	--	--	--	Indeno(1,2,3-cd)pyrene	N/A	--	--	--	--
			(Total)	--	6 53E-08	--	6 53E-08	(Total)		--	2 50E-02	--	2 50E-02

Total Risk Across Groundwater	2 03E-02
Total Risk Across Sediment	3 24E-07
Total Risk Across Surface Water	3 82E-05
Total Risk Across Test Pit Soil	1 35E-05
Total Risk Across All Media and All Exposure Routes	2 04E-02

Total Hazard Index Across Groundwater	2 35E+03
Total Hazard Index Across Sediment	2 00E-01
Total Hazard Index Across Surface Water	5 34E+00
Total Hazard Index Across Test Pit Soil	2 74E+00
Total Hazard Index Across All Media and All Exposure Routes	2 38E+03

Total Blood HI =	4 23E+01
Total CNS HI =	2 52E+00
Total CNS (Developmental) HI =	5 85E-02

AR302282

TABLE 10 (RAGs D 10 5 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - CHILD RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe Future
Receptor Population Resident
Receptor Age Child (age 1-6)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
												Total GI Tract HI =	1 01E+01
												Total Immune HI =	3 46E+01
												Total Kidney HI =	2 08E+03
												Total Liver HI =	2 16E+03
												Total Lung HI =	5 91E-04
												Total Skin HI =	4 82E-01
												Total Thymus HI =	2 37E+00
												Total Vascular HI =	4 82E-01

Notes
** Background analysis shows that risks may be attributable to background See Appendix J (Part 3) Table 15

Total Risks were above significance (> 1E-04 cancer risk or target organ HI >1) for groundwater contact Chemicals contributing significantly to these cancer risks or target organ HIs are shown
*** The total risks shown for this medium and exposure point include only risk drivers which in conjunction comprise 90% of the Total Cancer Risk or 90% of the noncancer HI for a particular target organ, or individually have cancer risk > 1E-04 or HQ > 1 0
For exposure points having total cancer risk <= 1E-04 and non-cancer HI <= 1 for each target organ, all chemicals are shown to document minimal risk

TABLE 10 (RAGs D 10 6 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - ADULT RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing & Der) with Groundwater (Center of Plume)	Iron	--	--	--	--	Iron**	Liver/Blood/GI Tract	2 80E+00	--	--	2 80E+00
			1,1,2-Trichloroethane	6 05E-04	--	--	6 05E-04	1 1,2-Trichloroethane		7 74E+00	--	--	7 74E+00
			1,1-Dichloroethene	5 24E-03	--	--	5 24E-03	1,1-Dichloroethene	Liver	2 83E+00	--	--	2 83E+00
			1,2-Dichloroethane	7 95E-04	--	--	7 95E-04	1,2-Dichloroethane	CNS/Thymus/GI Tract	8 49E-01	--	--	8 49E-01
			1,2-Dichloroethene (Total)	--	--	--	--	1,2-Dichloroethene (Total)	Liver	3 20E+00	--	--	3 20E+00
			Benzene	4 80E-04	--	--	4 80E-04	Benzene	Blood/Immune	8 49E+00	--	--	8 49E+00
			Carbon Tetrachloride	1 31E-03	--	--	1 31E-03	Carbon Tetrachloride		4 19E+01	--	--	4 19E+01
			Chloroform	5 73E-05	--	--	5 73E-05	Chloroform	Liver	2 74E+00	--	--	2 74E+00
			Tetrachloroethene	7 82E-04	--	--	7 82E-04	Tetrachloroethene	Liver	4 38E+00	--	--	4 38E+00
			Trichloroethene	6 85E-03	--	--	6 85E-03	Trichloroethene	Liver/Kidney	3 03E+02	--	--	3 03E+02
			(Total)***	1 61E-02	--	--	1 61E-02	(Total)***		3 78E+02	--	--	3 78E+02
	Vapors	Inhalation of Groundwater Vapors During Showering	1,1,2-Trichloroethane	--	7 86E-04	--	7 86E-04	1,1,2-Trichloroethane	N/A	--	--	--	--
			1,1-Dichloroethene	--	2 70E-03	--	2 70E-03	1,1-Dichloroethene	N/A	--	--	--	--
			1,2-Dichloroethane	--	1 22E-03	--	1 22E-03	1,2-Dichloroethane	Immune	--	2 80E+01	--	2 80E+01
			Benzene	--	4 71E-04	--	4 71E-04	Benzene	Blood	--	2 79E+01	--	2 79E+01
			Carbon Tetrachloride	--	7 90E-04	--	7 90E-04	Carbon Tetrachloride		--	7 61E+01	--	7 61E+01
			Chloroform	--	1 19E-03	--	1 19E-03	Chloroform	Respiratory	--	4 98E+02	--	4 98E+02
			Tetrachloroethene	--	4 31E-05	--	4 31E-05	Tetrachloroethene	Liver/Kidney	--	4 49E-01	--	4 49E-01
			Trichloroethene	--	5 82E-03	--	5 82E-03	Trichloroethene	N/A	--	--	--	--
			(Total)***	--	1 22E-02	--	1 22E-02	(Total)***		--	6 30E+02	--	6 30E+02
Surface Water	Surface Water	Contact (Ing & Der) with Surface Water (SW10) During Swimming Activities	Tetrachloroethene	1 25E-09	--	7 51E-06	7 51E-06	Tetrachloroethene	Liver	7 02E-06	--	4 21E-02	4 21E-02
			Trichloroethene	1 43E-08	--	4 46E-05	4 46E-05	Trichloroethene	Liver/Kidney	8 32E-04	--	1 97E+00	1 97E+00
			(Total)***	1 56E-08	--	5 21E-05	5 21E-05	(Total)***		6 39E-04	--	2 01E+00	2 01E+00
Surface Water	Surface Water	Contact (Ing & Der) with Surface Water (SW10) During Wading Activities	Tetrachloroethene	5 03E-10	--	3 32E-06	3 32E-06	Tetrachloroethene	Liver	2 82E-06	--	1 86E-02	1 86E-02
			Trichloroethene	5 75E-09	--	2 27E-05	2 27E-05	Trichloroethene	Liver/Kidney	2 54E-04	--	1 00E+00	1 00E+00
			(Total)***	6 25E-09	--	2 60E-05	2 60E-05	(Total)***		2 57E-04	--	1 02E+00	1 02E+00
Surface Water	Animal Tissue	Ingestion of Recreationally Caught Fish (Park Crk)	Aluminum	--	--	--	--	Aluminum	CNS (Developmental)	1 04E-02	--	--	1 04E-02
			Arsenic	4 90E-06	--	--	4 90E-06	Arsenic	Skin/Vascular	3 17E-02	--	--	3 17E-02
			Barium	--	--	--	--	Barium	Kidney	4 15E-03	--	--	4 15E-03
			(Total)	4 90E-06	--	--	4 90E-06	(Total)		4 62E-02	--	--	4 62E-02

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TABLE 10 (RAGs D 10 6 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - ADULT RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe Future
Receptor Population Resident
Receptor Age Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Contact (Ing & Der) with Sediment (SD10) During Swimming Activities	Aluminum	–	–	–	–	Aluminum	CNS (Developmental)	2 44E-04	–	1 94E-03	2 19E-03
			Arsenic	2 66E-08	–	1 83E-07	2 09E-07	Arsenic	Skin/Vascular	1 72E-04	–	1 18E-03	1 36E-03
			Chromium	–	–	–	–	Chromium	Kidney	1 37E-04	–	1 18E-02	1 19E-02
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	1 92E-03	–	4 11E-03	6 03E-03
			Manganese	–	–	–	–	Manganese	CNS	3 49E-04	–	1 87E-02	1 90E-02
			(Total)	2 66E-08	–	1 83E-07	2 09E-07	(Total)		2 82E-03	–	3 77E-02	4 05E-02
Sediment	Sediment	Contact (Ing & Der) with Sediment (SD10) During Wading Activities	Aluminum	–	–	–	–	Aluminum	CNS (Developmental)	4 89E-04	–	1 94E-03	2 43E-03
			Arsenic	5 32E-08	–	1 83E-07	2 36E-07	Arsenic	Skin/Vascular	3 45E-04	–	1 18E-03	1 53E-03
			Chromium	–	–	–	–	Chromium	Kidney	2 75E-04	–	1 18E-02	1 21E-02
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	3 83E-03	–	4 11E-03	7 95E-03
			Manganese	–	–	–	–	Manganese	CNS	6 97E-04	–	1 87E-02	1 94E-02
			(Total)	5 32E-08	–	1 83E-07	2 36E-07	(Total)		5 64E-03	–	3 77E-02	4 34E-02
Test Pit Soil	Test Pit Soil	Contact (Ing & Der) with Test Pit Soil	Aluminum	–	–	–	–	Aluminum	CNS (Developmental)	3 75E-02	–	4 13E-03	4 17E-02
			Arsenic	6 26E-06	–	5 95E-07	6 86E-06	Arsenic	Skin/Vascular	4 06E-02	–	3 86E-03	4 45E-02
			Chromium	–	–	–	–	Chromium	Kidney	3 25E-02	–	3 86E-02	7 11E-02
			Iron	–	–	–	–	Iron	Liver/Blood/GI Tract	2 10E-01	–	6 24E-03	2 16E-01
			Manganese	–	–	–	–	Manganese	CNS	5 76E-02	–	4 28E-02	1 00E-01
			Thallium	–	–	–	–	Thallium	Liver	6 97E-02	–	2 07E-03	7 17E-02
			Vanadium	–	–	–	–	Vanadium	NOAEL	2 37E-02	–	2 70E-02	5 07E-02
			Aroclor-1260	1 10E-06	–	1 96E-07	1 29E-06	Aroclor-1260	N/A	–	–	–	–
			Benz(a)anthracene	3 43E-07	–	–	3 43E-07	Benz(a)anthracene	N/A	–	–	–	–
			Benzo(a)pyrene	4 56E-06	–	–	4 56E-06	Benzo(a)pyrene	N/A	–	–	–	–
			Benzo(b)fluoranthene	4 08E-07	–	–	4 08E-07	Benzo(b)fluoranthene	N/A	–	–	–	–
			Benzo(k)fluoranthene	3 77E-08	–	–	3 77E-08	Benzo(k)fluoranthene	N/A	–	–	–	–
			Carbazole	3 14E-09	–	9 32E-10	4 07E-09	Carbazole	N/A	–	–	–	–
			Chrysene	3 53E-09	–	–	3 53E-09	Chrysene	N/A	–	–	–	–
			Dibenz(a,h)anthracene	1 09E-06	–	–	1 09E-06	Dibenz(a,h)anthracene	N/A	–	–	–	–
			Indeno(1,2,3-cd)pyrene	3 67E-07	–	–	3 67E-07	Indeno(1,2,3-cd)pyrene	N/A	–	–	–	–
			(Total)	1 42E-05	–	7 92E-07	1 50E-05	(Total)		4 72E-01	–	1 25E-01	5 96E-01
	Vapors	Ambient VOC inhalation from Test Pit Soil	Benz(a)anthracene	–	–	–	–	Benz(a)anthracene	N/A	–	–	–	–
			Benzo(a)pyrene	–	1 22E-08	–	1 22E-08	Benzo(a)pyrene	N/A	–	–	–	–
			Benzo(b)fluoranthene	–	–	–	–	Benzo(b)fluoranthene	N/A	–	–	–	–
			Benzo(k)fluoranthene	–	–	–	–	Benzo(k)fluoranthene	N/A	–	–	–	–
			Carbazole	–	–	–	–	Carbazole	N/A	–	–	–	–
			Chrysene	–	–	–	–	Chrysene	N/A	–	–	–	–
			Dibenz(a,h)anthracene	–	–	–	–	Dibenz(a,h)anthracene	N/A	–	–	–	–
			Indeno(1,2,3-cd)pyrene	–	–	–	–	Indeno(1,2,3-cd)pyrene	N/A	–	–	–	–
			(Total)	–	1 22E-08	–	1 22E-08	(Total)		–	–	–	–

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TABLE 10 (RAGs D 10 6 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - ADULT RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe Future
Receptor Population Resident
Receptor Age Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Test Pit Soil	Particulates	Particulate Dust Inhalation *from Test Pit Soil*											
			Aluminum	--	--	--	--	Aluminum	CNS	--	2 25E-03	--	2 25E-03
			Arsenic	--	3 77E-09	--	3 77E-09	Arsenic	N/A	--	--	--	--
			Chromium	--	8 21E-08	--	8 21E-08	Chromium	Lung	--	1 95E-04	--	1 95E-04
			Iron	--	--	--	--	Iron	N/A	--	--	--	--
			Manganese	--	--	--	--	Manganese	CNS	--	5 79E-03	--	5 79E-03
			Thallium	--	--	--	--	Thallium	N/A	--	--	--	--
			Vanadium	--	--	--	--	Vanadium	N/A	--	--	--	--
			Aroclor-1260	--	6 58E-11	--	6 58E-11	Aroclor-1260	N/A	--	--	--	--
			Benz(a)anthracene	--	--	--	--	Benz(a)anthracene	N/A	--	--	--	--
			Benzo(a)pyrene	--	1 16E-10	--	1 16E-10	Benzo(a)pyrene	N/A	--	--	--	--
			Benzo(b)fluoranthene	--	--	--	--	Benzo(b)fluoranthene	N/A	--	--	--	--
			Benzo(k)fluoranthene	--	--	--	--	Benzo(k)fluoranthene	N/A	--	--	--	--
			Carbazole	--	--	--	--	Carbazole	N/A	--	--	--	--
			Chrysene	--	--	--	--	Chrysene	N/A	--	--	--	--
			Dibenz(a,h)anthracene	--	--	--	--	Dibenz(a,h)anthracene	N/A	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	--	--	--	Indeno(1,2,3-cd)pyrene	N/A	--	--	--	--
			(Total)	--	8 60E-08	--	8 60E-08	(Total)		--	8 23E-03	--	8 23E-03

Total Risk Across Groundwater	2 84E-02
Total Risk Across Sediment	4 45E-07
Total Risk Across Surface Water	8 30E-05
Total Risk Across Test Pit Soil	1 51E-05
Total Risk Across All Media and All Exposure Routes	2 85E-02

Total Hazard Index Across Groundwater	1 01E+03
Total Hazard Index Across Sediment	6 39E-02
Total Hazard Index Across Surface Water	3 08E+00
Total Hazard Index Across Test Pit Soil	6 04E-01
Total Hazard Index Across All Media and All Exposure Routes	1 01E+03

Total Blood HI =	3 94E+01
Total CNS HI =	1 05E+00
Total CNS (Developmental) HI =	5 67E-02
Total GI Tract HI =	3 88E+00
Total Immune HI =	3 65E+01
Total Kidney HI =	3 08E+02
Total Liver HI =	3 15E+02
Total Lung HI =	1 95E-04
Total NOAEL HI =	5 07E-02
Total Respiratory HI =	4 98E+02
Total Skin HI =	7 91E-02
Total Thymus HI =	8 49E-01
Total Vascular HI =	7 91E-02

Notes
** Background analysis shows that risks may be attributable to background See Appendix J (Part 3) Table 15

Total Risks were above significance (> 1E-04 cancer risk or target organ HI >1) for groundwater contact and inhalation exposure points. Chemicals contributing significantly to these cancer risks or target organ HIs are shown
*** The total risks shown for this medium and exposure point include only risk drivers which in conjunction comprise 90% of the Total Cancer Risk or 90% of the noncancer HI for a particular target organ, or individually have cancer risk > 1E-04 or HQ > 1 0
For exposure points having total cancer risk <= 1E-04 and non-cancer HI <= 1 for each target organ, all chemicals are shown to document minimal risk.

TABLE 10 (RAGs D 10 7 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - LIFETIME RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe Future
Receptor Population Resident
Receptor Age Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Contact (Ing & Der) with Groundwater (Center of Plume)											
			1,1,2-Trichloroethane	1 02E-03	--	2 32E-05	1 04E-03	1,1,2-Trichloroethane	N/A	N/A	--	N/A	--
			1,1-Dichloroethene	8 81E-03	--	2 95E-04	9 10E-03	1,1-Dichloroethene	N/A	N/A	--	N/A	--
			1,2-Dichloroethane	1 34E-03	--	1 50E-05	1 35E-03	1,2-Dichloroethane	N/A	N/A	--	N/A	--
			Benzene	8 07E-04	--	1 63E-04	9 70E-04	Benzene	N/A	N/A	--	N/A	--
			Carbon Tetrachloride	2 20E-03	--	1 51E-04	2 35E-03	Carbon Tetrachloride	N/A	N/A	--	N/A	--
			Chloroform	9 63E-05	--	3 08E-05	1 27E-04	Chloroform	N/A	N/A	--	N/A	--
			Tetrachloroethene	1 31E-03	--	1 66E-03	2 97E-03	Tetrachloroethene	N/A	N/A	--	N/A	--
			Trichloroethene	1 15E-02	--	7 05E-03	1 86E-02	Trichloroethene	N/A	N/A	--	N/A	--
			(Total)***	2 71E-02	--	9 39E-03	3 65E-02	(Total)		--	--	--	--
	Vapors	Inhalation of Groundwater Vapors During Showering											
			1,1-Dichloroethene	--	2 70E-03	--	2 70E-03	1,1-Dichloroethene	N/A	--	N/A	--	--
			1,1,2-Trichloroethane	--	7 86E-04	--	7 86E-04	1,1,2-Trichloroethane	N/A	--	N/A	--	--
			Benzene	--	4 71E-04	--	4 71E-04	Benzene	N/A	--	N/A	--	--
			Tetrachloroethene	--	4 31E-05	--	4 31E-05	Tetrachloroethene	N/A	--	N/A	--	--
			1,2-Dichloroethane	--	1 22E-03	--	1 22E-03	1,2-Dichloroethane	N/A	--	N/A	--	--
			Carbon Tetrachloride	--	7 90E-04	--	7 90E-04	Carbon Tetrachloride	N/A	--	N/A	--	--
			Chloroform	--	1 19E-03	--	1 19E-03	Chloroform	N/A	--	N/A	--	--
			Trichloroethene	--	5 82E-03	--	5 82E-03	Trichloroethene	N/A	--	N/A	--	--
			(Total)***	--	1 30E-02	--	1 30E-02	(Total)		--	--	--	--
Surface Water	Surface Water	Contact (Ing & Der) with Surface Water (SW10) During Swimming Activities											
			Tetrachloroethene	2 57E-09	--	1 07E-05	1 07E-05	Tetrachloroethene	N/A	N/A	--	N/A	--
			Trichloroethene	2 94E-08	--	6 33E-05	6 34E-05	Trichloroethene	N/A	N/A	--	N/A	--
			(Total)	3 20E-08	--	7 40E-05	7 41E-05	(Total)		--	--	--	--
Surface Water	Surface Water	Contact (Ing & Der) with Surface Water (SW10) During Wading Activities											
			Tetrachloroethene	1 03E-09	--	4 75E-06	4 75E-06	Tetrachloroethene	N/A	N/A	--	N/A	--
			Trichloroethene	1 18E-08	--	3 25E-05	3 25E-05	Trichloroethene	N/A	N/A	--	N/A	--
			(Total)	1 28E-08	--	3 73E-05	3 73E-05	(Total)		--	--	--	--
Surface Water	Animal Tissue	Ingestion of Recreationally Caught Fish (Perk Crk)											
			Arsenic	1 01E-05	--	--	1 01E-05	Arsenic	N/A	N/A	--	--	--
			(Total)	1 01E-05	--	--	1 01E-05	(Total)		--	--	--	--
Sediment	Sediment	Contact (Ing & Der) with Sediment (SD10) During Swimming Activities											
			Arsenic	8 26E-08	--	2 60E-07	3 43E-07	Arsenic	N/A	N/A	--	N/A	--
			(Total)	8 26E-08	--	2 60E-07	3 43E-07	(Total)		--	--	--	--
Sediment	Sediment	Contact (Ing & Der) with Sediment (SD10) During Wading Activities											
			Arsenic	1 65E-07	--	2 60E-07	4 25E-07	Arsenic	N/A	N/A	--	N/A	--
			(Total)	1 65E-07	--	2 60E-07	4 25E-07	(Total)		--	--	--	--

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TABLE 10 (RAGs D 10 7 RME)
RISK ASSESSMENT SUMMARY OF MULTIPLE PATHWAYS - LIFETIME RESIDENT MAXIMUM EXPOSURE TO ALL CROSSLEY FARM SITE MEDIA
REASONABLE MAXIMUM EXPOSURE
CROSSLEY FARM SITE, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Test Pit Soil	Test Pit Soil	Contact (Ing. & Der.) with Test Pit Soil	Arsenic	1.95E-05	--	7.96E-07	2.03E-05	Arsenic	N/A	N/A	--	N/A	--
			Aroclor-1260	3.42E-06	--	2.62E-07	3.68E-06	Aroclor-1260	N/A	N/A	--	N/A	--
			Benz(a)anthracene	1.07E-06	--	--	1.07E-06	Benz(a)anthracene	N/A	N/A	--	N/A	--
			Benzo(a)pyrene	1.42E-05	--	--	1.42E-05	Benzo(a)pyrene	N/A	N/A	--	N/A	--
			Benzo(b)fluoranthene	1.27E-06	--	--	1.27E-06	Benzo(b)fluoranthene	N/A	N/A	--	N/A	--
			Benzo(k)fluoranthene	1.17E-07	--	--	1.17E-07	Benzo(k)fluoranthene	N/A	N/A	--	N/A	--
			Carbazole	9.75E-09	--	1.25E-09	1.10E-08	Carbazole	N/A	N/A	--	N/A	--
			Chrysene	1.10E-08	--	--	1.10E-08	Chrysene	N/A	N/A	--	N/A	--
			Dibenz(a,h)anthracene	3.40E-06	--	--	3.40E-06	Dibenz(a,h)anthracene	N/A	N/A	--	N/A	--
			Indeno(1,2,3-cd)pyrene	1.14E-06	--	--	1.14E-06	Indeno(1,2,3-cd)pyrene	N/A	N/A	--	N/A	--
			(Total)	4.41E-05	--	1.08E-06	4.51E-05	(Total)		--	--	--	--
	Vapors	Ambient VOC Inhalation from Test Pit Soil	Benzo(a)pyrene	--	2.14E-08	--	2.14E-08	Benzo(a)pyrene	N/A	--	N/A	--	--
			(Total)	--	2.14E-08	--	2.14E-08	(Total)		--	--	--	--
	Particulates	Particulate Dust Inhalation from Test Pit Soil	Arsenic	--	6.64E-09	--	6.64E-09	Arsenic	N/A	--	N/A	--	--
			Chromium	--	1.44E-07	--	1.44E-07	Chromium	N/A	--	N/A	--	--
			Aroclor-1260	--	1.18E-10	--	1.18E-10	Aroclor-1260	N/A	--	N/A	--	--
			Benzo(a)pyrene	--	2.04E-10	--	2.04E-10	Benzo(a)pyrene	N/A	--	N/A	--	--
			(Total)	--	1.51E-07	--	1.51E-07	(Total)		--	--	--	--
						Total Risk Across Groundwater	4.95E-02					Total Hazard Index Across Groundwater	--
						Total Risk Across Sediment	7.68E-07					Total Hazard Index Across Sediment	--
						Total Risk Across Surface Water	1.21E-04					Total Hazard Index Across Surface Water	--
						Total Risk Across Test Pit Soil	4.53E-05					Total Hazard Index Across Test Pit Soil	--
						Total Risk Across All Media and All Exposure Routes	4.97E-02					Total Hazard Index Across All Media and All Exposure Routes	--

Notes:
For exposure points having total cancer risk <= 1E-04, all chemicals are shown to document minimal risk
***Total Risks were above significance (1E-04 cancer risk) for groundwater contact and inhalation exposure points. Chemicals contributing significantly to these cancer risks (in conjunction comprising 90% of the groundwater contact or inhalation Total Risks) and chemicals individually greater than 1E-04 cancer risk are shown.

Ecological Risk Assessment

The ecological risk assessment for the RI and the food chain modeling suggest that the concentration of certain contaminants at the Crossley Farm Site may be adversely affecting some of the more sensitive receptors, especially those receptors that are relatively immobile and spend extended periods of time in one of the locations that has a significant concentration of contaminants.

It is significant that the concentration of TCE and other volatile compounds in the springs present only a localized effect and that even though the number of sediment dwelling organisms may have been impacted at these spring locations, the number of other springs in the wetlands and local vicinity still provide available locations for the local predator populations.

There is also one location, SD-18, where the concentrations of aluminum presented a concern when evaluating the food chain pathway for wildlife that consumes a number of insects and soil invertebrates. However the effects are localized and would not be present over the entire site area and down the valley. Furthermore, aluminum is a naturally occurring metal and not related to any hazardous waste disposal at the Site, based on EPA's information to date.

Basis of Action

It is the lead agency's current judgement that the Preferred Alternative identified in this Proposed Plan, or one of the other measures considered in this Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from the site which may present an imminent and substantial endangerment to public health or welfare.

VIII. REMEDIAL ACTION OBJECTIVES

The primary objectives for this groundwater operable unit are to contain the contamination in the fractured bedrock aquifer at the Site and to reduce the contamination in the aquifer and the surface water springs to MCLs or below.

This objective is consistent with the past actions of providing carbon filtration units to affected residents to protect their health and welfare and the previous removal of identified source areas at the Site.

IX. DESCRIPTION OF GROUNDWATER ALTERNATIVES

CERCLA requires that any remedy selected to address contamination at a hazardous waste site must be protective of public health, welfare, and the environment, be cost-effective, be in compliance with regulatory and statutory provisions that are applicable or relevant and appropriate requirements ("ARARs"), and be consistent with the NCP. CERCLA also expresses a preference for permanent solutions, for treating hazardous substances on-site, and for applying alternative or innovative technologies.

The Feasibility Study discusses the full range of alternatives evaluated for the Site and provides supporting information relating to the alternatives in the Proposed Plan. The Proposed Plan discussed a No Action alternative, as required by the NCP at 40 CFR §300.430 (e)(6), and other alternatives that were determined by EPA to be protective of human health and the environment, achieve state and federal regulatory requirements, and best achieve the cleanup goals for the Site. These alternatives were derived from those presented in the Feasibility Study Report.

Alternative 1 - *No Action*

Under this alternative, no measures would be taken to contain and / or treat the contaminated groundwater plume. The source area on the top of Black Head Hill would continue to migrate in the groundwater and continue to discharge at spring locations and flow into the surface water of the Perkiomen Creek.

No restrictions on current or future use of groundwater would be made.

As required by CERCLA a review of Site conditions would be conducted every five years because contaminants would remain in groundwater beneath the Site.

Capital O & M and Present Worth Costs $0

Alternative 2 - Institutional Controls and Groundwater Monitoring

The institutional controls would be to monitor the groundwater and restrict the use of contaminated groundwater at the Site.

Groundwater extraction wells shall not be installed and contaminated groundwater at the Crossley Farm Superfund Site, including but not limited to the areas of Huff's Church Road, Dale Road, Forgedale Road, Dairy Lane, Airport Road and Camp Mench Mill Road shall not be used unless treatment units are installed and maintained to ensure that any water used has contaminant levels at or below MCLs. This could be achieved with local government restrictions on the use of groundwater.

Because the June 1997 ROD is now complete, as discussed above, any new property construction over the contaminated groundwater plume after February 2001 would not receive carbon filtration units paid for by EPA.

Groundwater monitoring under this alternative would be a remedial action. Sampling of residential wells and springs would be conducted every 6 months.

As required by CERCLA a review of Site conditions would be conducted every five years because contaminants would remain in groundwater beneath the Site.

Capital costs	$ 16,074
O & M Costs	$ 21,900
Present Worth Costs	$581,148

Alternative No. 3- Groundwater Containment of Center of Plume and On-Site Treatment / Recharge

This alternative would require construction of a groundwater extraction well system on the top of Blackhead Hill to contain the area of concentrations for TCE greater than 1000 ug/l.

This alternative would need additional design investigations to determine the exact locations and number of extraction wells to achieve containment in the complex fractured bedrock.

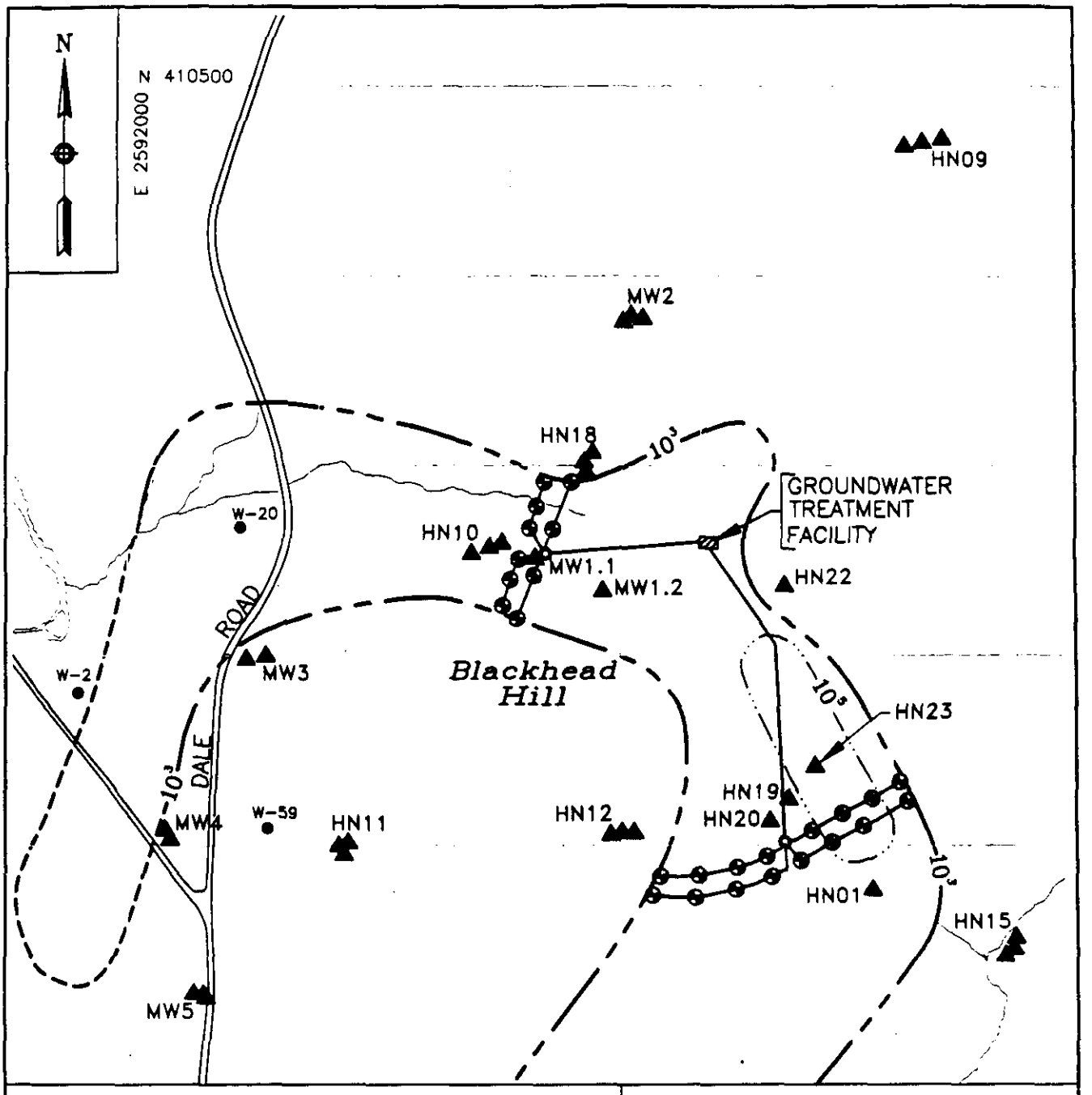
Figure 9 shows a conceptual drawing of how the alternative could be constructed. The extraction wells are located on the western and southern edges of the borrow pit area and are located within the 10^3 contour boundary which shows the boundaries of the 1000 ug/l concentration.

For the cost estimating purposes it is assumed that a total of 41 wells drilled to depths of 100 to 400 feet would be installed and pumping rates would be approximately 320 gallons per minute ("gpm"). The cost estimate is based on a 30 year period of operation.

Groundwater treatment would be at an on-site plant using an air stripping process to transfer the volatile compounds from the groundwater to a vapor phase which can be captured in an off-gas treatment system. The treated water would be run through an additional carbon polishing unit prior to discharge.

The recharge system for groundwater would be constructed to discharge the water into the shallow and intermediate aquifer by pumping the treated water to specifically constructed trenches in the wooded areas of the farm or into wells screened into the shallow and intermediate water bearing zones.

Institutional controls and monitoring as described in Alternative 2 would also apply to this alternative.



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE INTERMEDIATE AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

- EXTRACTION WELL
- DOUBLE WALL PVC PIPE
- TRANSFER SUMP

0 400 800

SCALE IN FEET

ALTERNATIVE 3

GROUNDWATER CONTAINMENT OF CENTER OF PLUME AND ON-SITE TREATMENT/RECHARGE
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 9

As required by CERCLA, a review of Site conditions would be conducted every five years because contaminants would remain in groundwater beneath the Site.

Capital costs	$ 6,704,932
O & M Costs	$ 2,258,976
Present Worth Costs	$14,609,180

Alternative 4- Groundwater Containment of Center of Plume, On-Site Treatment and Discharge to the West Branch of the Perkiomen Creek

The groundwater extraction and treatment system proposed in this alternative is identical to alternative 3 except the discharge of the treated groundwater (estimated at 320 gpm) would be through a 2000 foot pipeline constructed from the top of Black Head Hill to a location west of Dale Road as shown in Figure 10.

Institutional controls and monitoring as described above would also apply to this alternative.

As required by CERCLA a review of Site conditions would be conducted every five years because contaminants would remain in groundwater beneath the Site.

Capital costs	$ 6,339,215
O & M Costs	$ 2,256,429
Present Worth Costs	$14,211,857

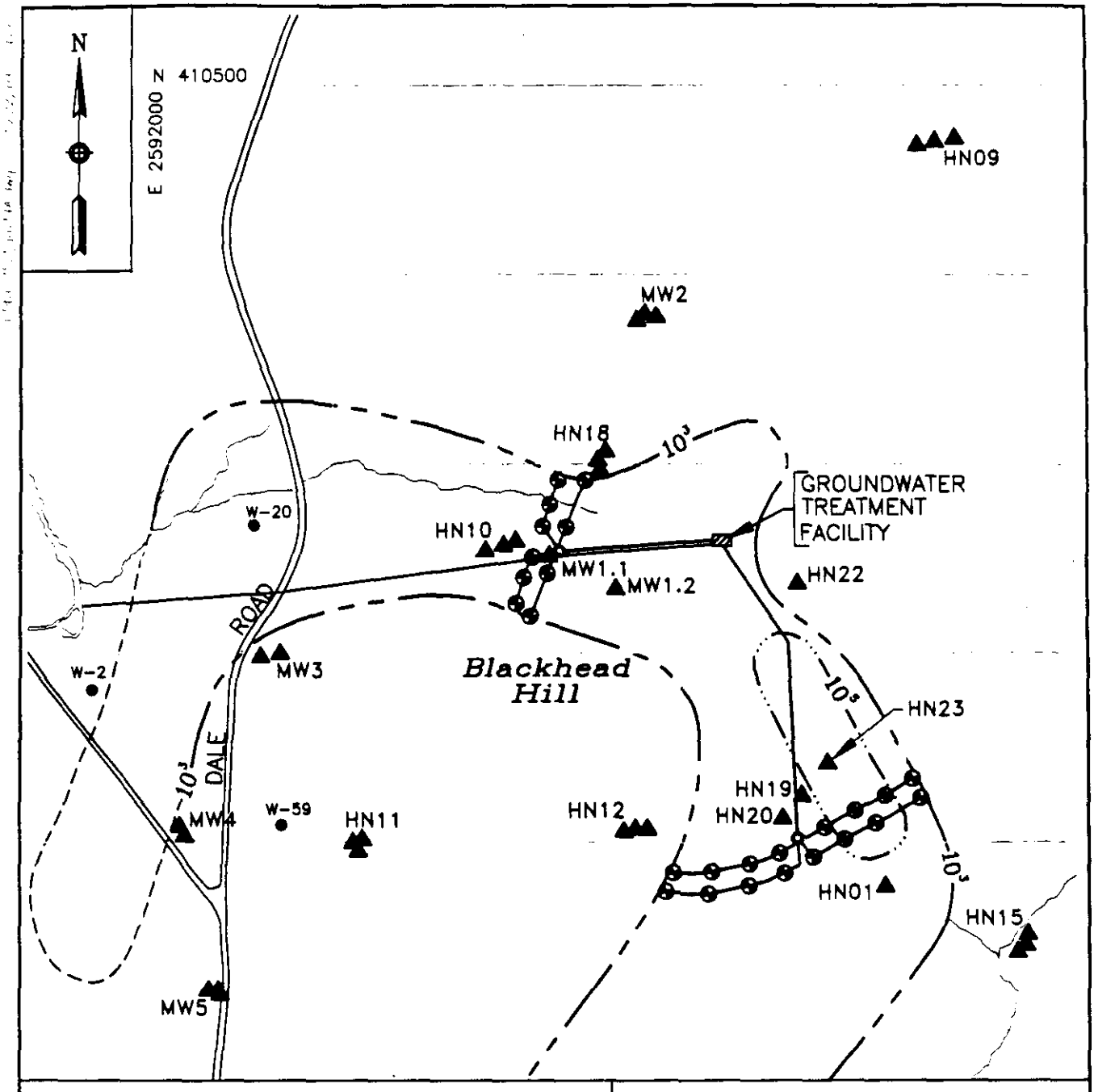
Alternative 5 - In-Situ Treatment of the Residual / Hot-Spot Plume

This Remedial Alternative would provide treatment for the highest concentration TCE contamination located immediately downgradient of the borrow pit area using an in-situ treatment of the contaminated groundwater below the surface without extracting the water for above ground treatment.

The area shown in Figure 11 shows the shaded area representing the location of concentration above 10^5or 100,000 ug/l. This is considered the hot-spot plume.

This alternative would require a pre-design investigation and treatability study to evaluate the Fenton's Chemistry oxidation process technology and the air sparging / vapor extraction technology.

In-situ chemical oxidation involves the application or injection of a strong oxidizing agent into the contaminated groundwater zone in order to degrade or break down the TCE into less toxic or benign compounds. Fentons Reagent is a solution of hydrogen peroxide and ferrous iron. When



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE INTERMEDIATE AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

- EXTRACTION WELL
- DOUBLE WALL PVC PIPE
- TRANSFER SUMP
- PROPOSED DISCHARGE LINE

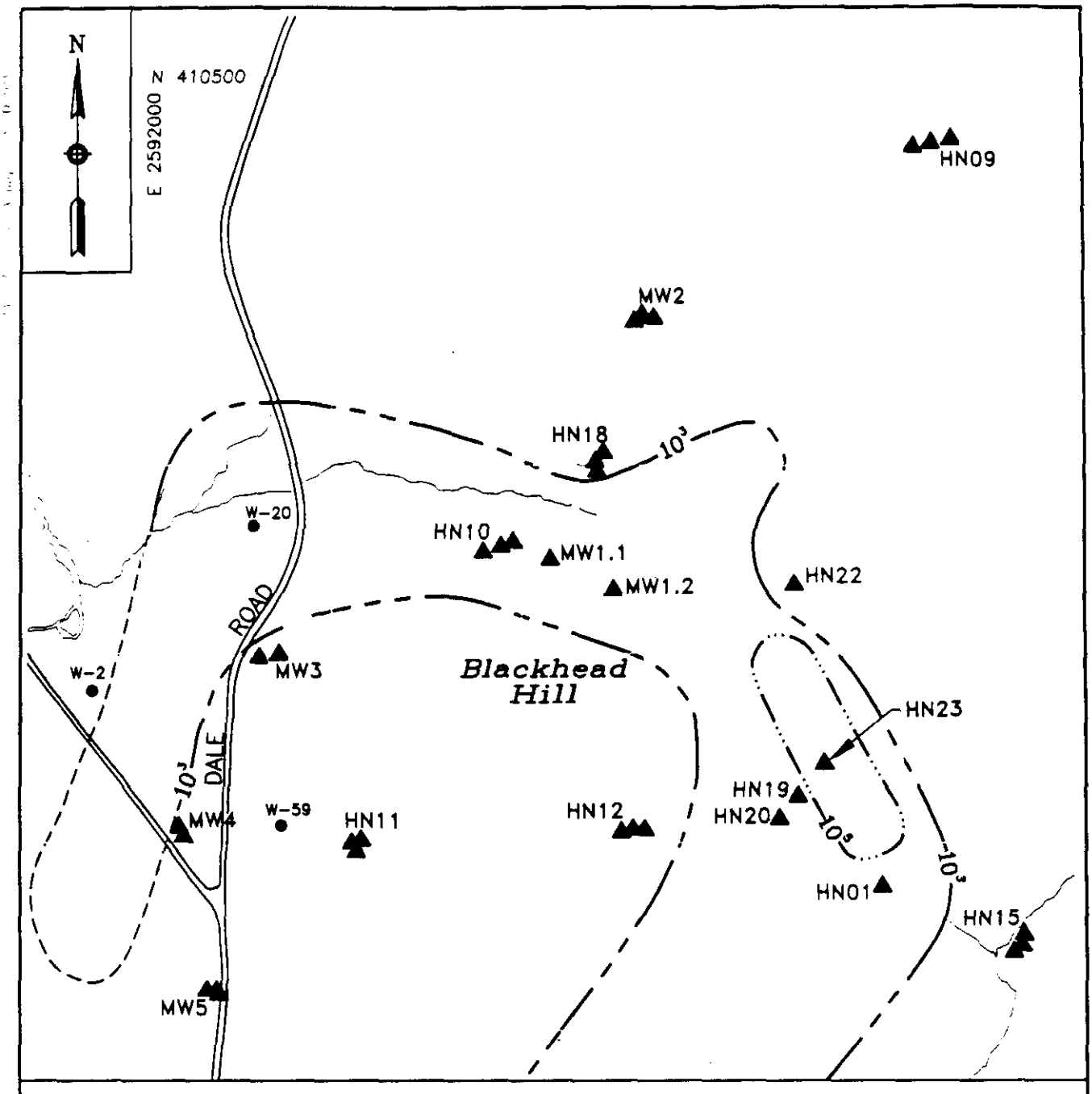
0 400 800

SCALE IN FEET

ALTERNATIVE 4

GROUNDWATER CONTAINMENT OF CENTER OF PLUME AND OFF-SITE DISCHARGE
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 10



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE INTERMEDIATE AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

▭ = PROPOSED AREA FOR IN-SITU TREATMENT

0 400 800

SCALE IN FEET

ALTERNATIVE 5

IN-SITU TREATMENT OF ON-SITE RESIDUAL/HOT SPOT PLUME

CROSSLEY FARM

HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 11

injected, the iron acts as a catalyst to create water, carbon dioxide and a diluted hydrochloric acid as byproducts.

Air sparging and vapor extraction injects air into the contaminated groundwater zone and then vacuums the volatile contaminants from the air space above the water table. Both the air injection and the vacuum are applied through a network of wells. The collected vapors are treated prior to discharge to the atmosphere.

For the purpose of this proposed plan it is assumed that in-situ treatment will need between 100 to 150 two inch wells. Additional monitoring wells would be needed to evaluate the effectiveness and breakdown of the TCE into carbon dioxide, oxygen and water.

Institutional controls and monitoring as described in Alternative 2 would also apply to this alternative.

As required by CERCLA a review of Site conditions would be conducted every five years because contaminants would remain in groundwater beneath the Site.

Capital costs	$ 7,593,660
O & M Costs	$ 215900
Present Worth Costs	$ 8,212,634

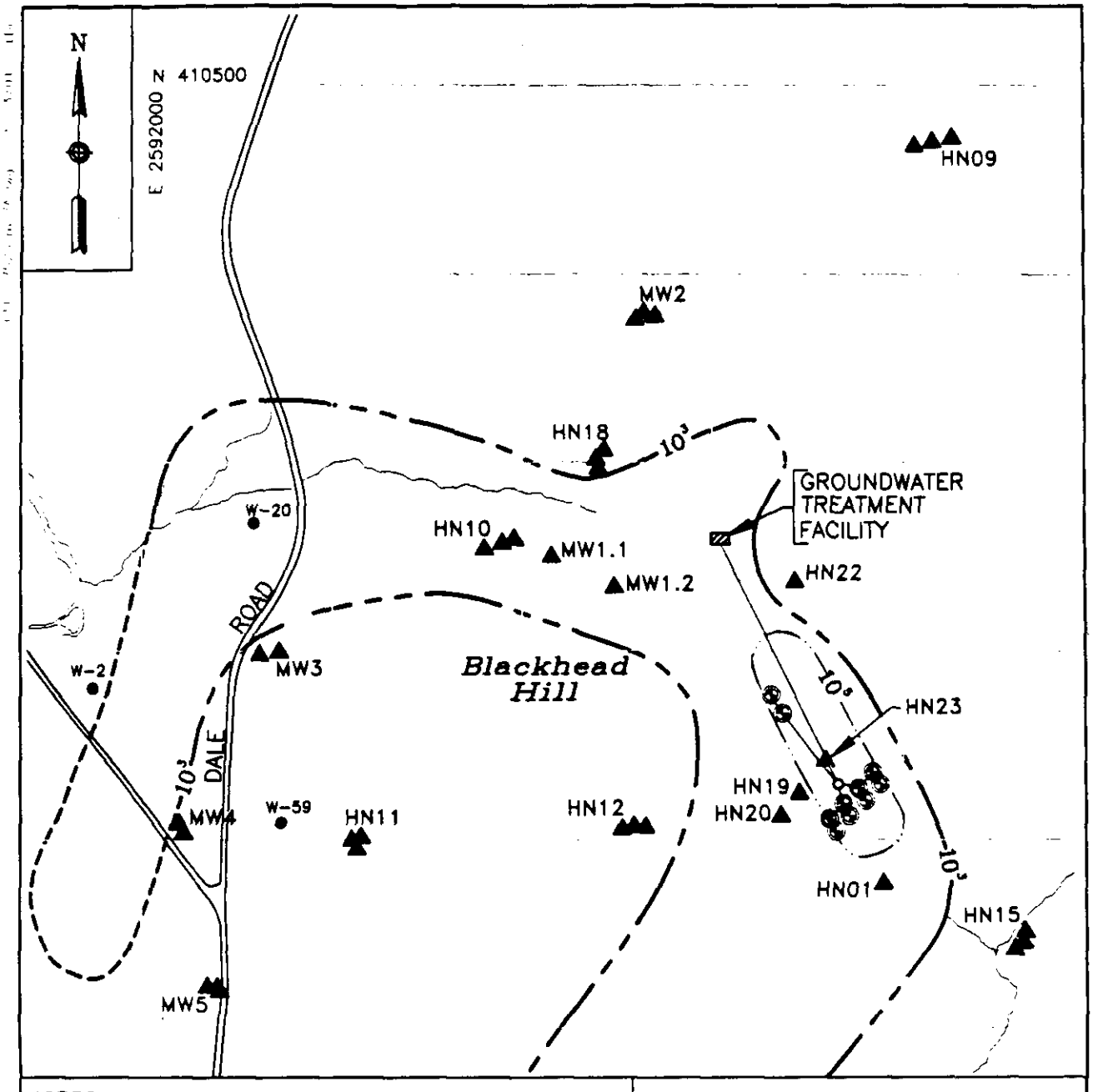
Alternative 6 - Residual Hot-Spot Plume Pumping and On-Site Treatment

This Remedial Alternative would provide extraction and treatment for the highest concentration TCE contamination located immediately downgradient of the borrow pit area using a limited number of extraction wells in the area represented by concentrations above 10^5 or 100,00 up/l of TCE.

This alternative would require additional groundwater sampling and aquifer characterization to better delineate the vertical and horizontal extent of contamination and to visually determine if the DNAPL exists.

As shown in Figure 12, the FS proposed installation of two wells in the borrow pit area at a depth of approximately 125 and 400 feet. Another 8 wells would be located to the southwest near the existing well HN-23 which contained the highest concentrations of 190,000 ug/l of TCE in the RI sampling. The 10 new wells would be pumped at a total rate of 5 to 30 gpm.

Groundwater treatment would be at an on-site plant using an air stripping process to transfer the volatile compounds from the groundwater to a vapor phase which can be captured in an off-gas treatment system. The treated water would be run through an additional carbon polishing unit prior to discharge.



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE INTERMEDIATE AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

- EXTRACTION WELL
- DOUBLE WALL PVC PIPE
- TRANSFER SUMP

0 400 800

SCALE IN FEET

ALTERNATIVE 6

RESIDUAL PLUME PUMPING AND ON-SITE TREATMENT/RECHARGE
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 12

The recharge system for groundwater would be constructed to discharge the water into the shallow and intermediate aquifer by pumping the treated water to specifically constructed trenches in the wooded areas of the farm or into wells screened into the shallow and intermediate water bearing zones.

Institutional controls and monitoring as described in Alternative 2 would also apply to this alternative.

As required by CERCLA a review of Site conditions would be conducted every five years because contaminants would remain in groundwater beneath the Site.

Capital costs	$ 3,607,300
O & M Costs	$ 1,164,872
Present Worth Costs	$ 8,649,466

Alternative 7- Groundwater Containment of Valley Plume, On-Site Treatment and Discharge to West Branch Perkiomen Creek

This alternative would address the plume of TCE contaminated groundwater that extends from the top of Blackhead Hill downgradient into the valley to the West Branch of the Perkiomen Creek and beyond towards the intersection of Dale and Forgedale Roads. The intent of this alternative is to capture and treat the groundwater before it flows into or beneath the Creek.

The conceptual design shown in Figure 13 would place well extraction systems in two separate locations within the area representing the 10^3 concentrations of TCE. One would be located on the west side of Dale Road and the other would be located on the eastern side crossing over Dairy Lane.

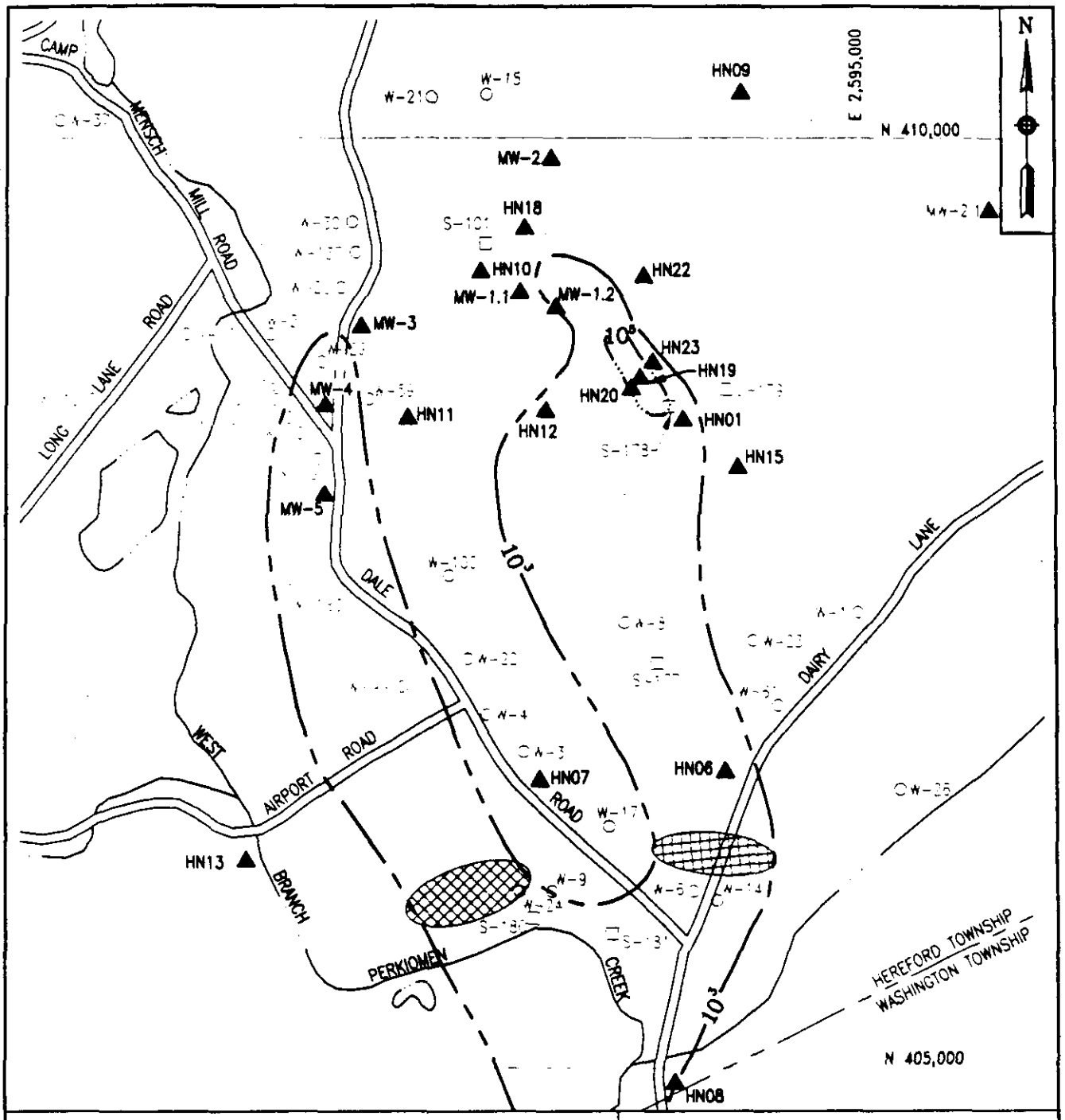
Based on preliminary calculations, a total of 22 extraction wells placed at depths up to 400 feet deep would be installed and estimated pumping rates would be about 440 gpm.

The treatment technology would be similar to the air stripping process described in Alternative 3, but each location would have its own treatment system and the treated water would flow through buried pipelines to the Creek.

The groundwater monitoring program would include all the valley monitoring wells.

Institutional controls and monitoring as described in Alternative 2 would also apply to this alternative

Capital costs	$ 5,366,997
O & M Costs	$ 223,120
Present Worth Costs	$ 8,627,074



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE DEEP AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

= APPROXIMATE LOCATION OF TREATMENT ZONES

0 800 1600

SCALE IN FEET

ALTERNATIVE 7

GROUNDWATER CONTAINMENT OF VALLEY PLUME, ON-SITE TREATMENT AND DISCHARGE TO WEST BRANCH

CROSSLEY FARM

HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 13

Alternative 8 - In-Situ Treatment of Valley Plume

This alternative would address the same locations , east and west valley plumes, as described in Alternative 7 and shown on Figure 14. However, the treatment process would be similar to the treatment technologies proposed for evaluation in Alternative 5 (in-situ chemical oxidation).

The groundwater monitoring program would be expanded to include all the valley monitoring wells and additional wells to evaluate the effectiveness and breakdown of the TCE into carbon dioxide, oxygen and water.

Institutional controls and monitoring as described in Alternative 2 would also apply to this alternative

Capital costs	$ 8,012,805
O & M Costs	$ 1,437,500
Present Worth Costs	$26,469,716

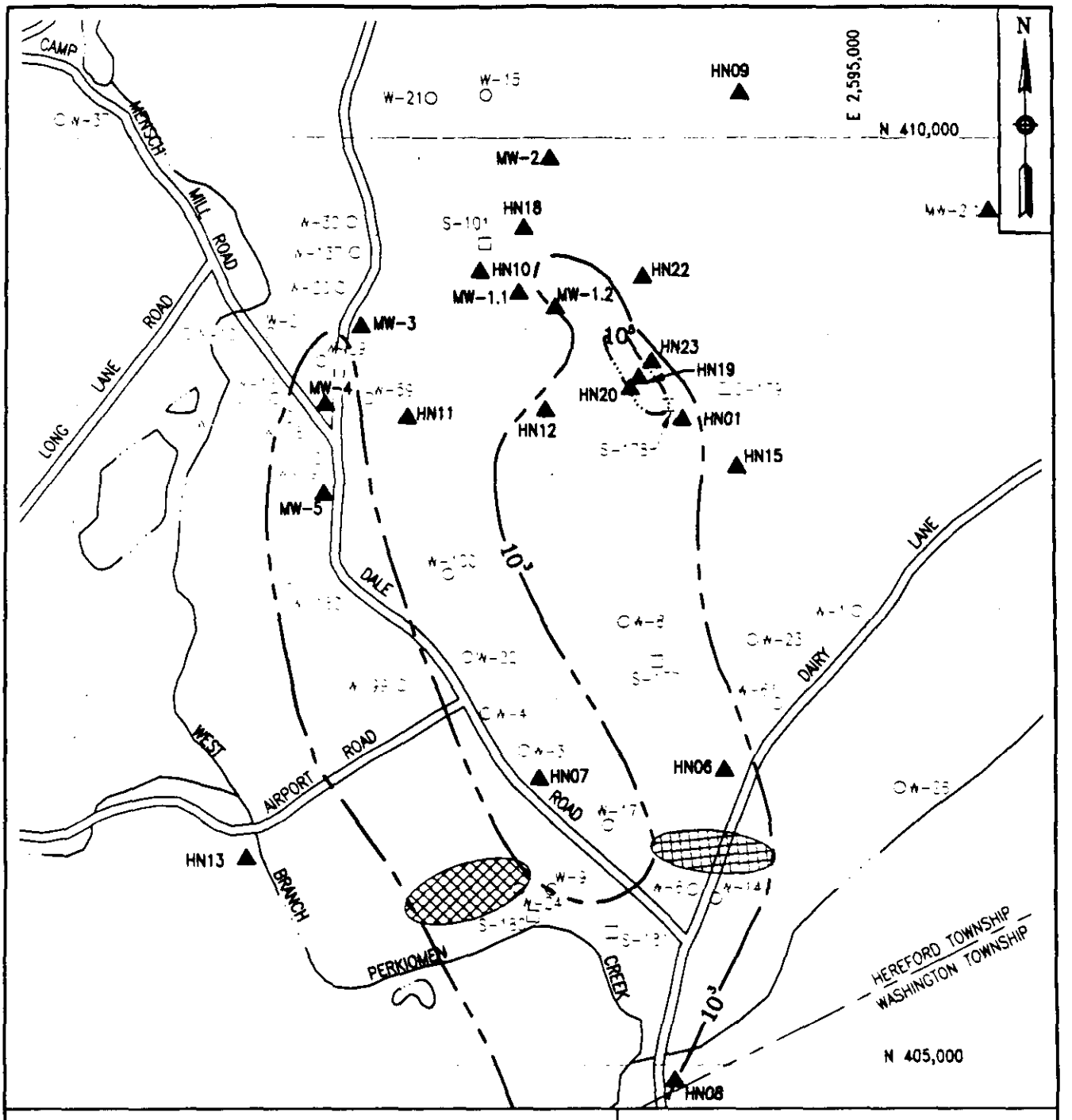
Alternative 9 - *Groundwater Containment of Center of Plume and Valley Plume, On-Site Treatment and Discharge to West Branch Perkiomen*

This alternative as shown in Figure 15 is the attempt to remediate both the top of the hill center of the plume, including the residual hot spot, and the valley plume. This is the most comprehensive alternative presented in the FS and would be the only alternative which would remediate the 10^3 concentrations of TCE and provide for the potential of natural attenuation for the concentrations less than 1000 ug/l.

It is essentially a combination of Alternative 3 and Alternative 7.

Institutional controls and monitoring as described in Alternative 2 would also apply to this alternative.

Capital costs	$10,250,770
O & M Costs	$ 2,256,429
Present Worth Costs	$20,818,415



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE DEEP AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

= APPROXIMATE LOCATION OF TREATMENT ZONES

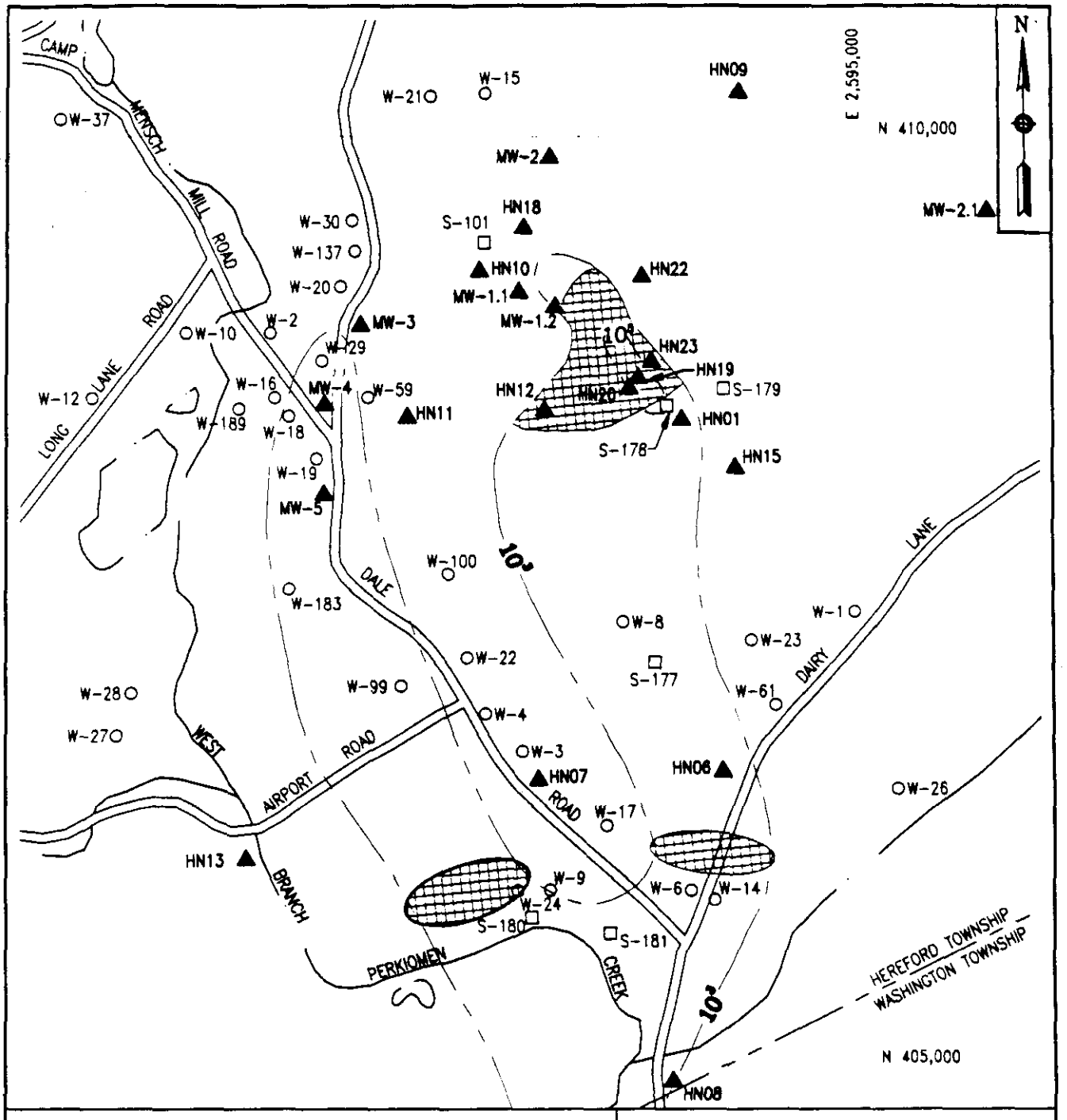
0 800 1600

SCALE IN FEET

ALTERNATIVE 8

IN-SITU TREATMENT OF VALLEY PLUME
CROSSLEY FARM
HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 14



NOTES:

1. ISOPLETHS ARE FOR TCE IN THE DEEP AQUIFER.
2. THIS IS A PRELIMINARY CONCEPTUAL DESIGN.

LEGEND

= APPROXIMATE LOCATION OF TREATMENT ZONES

0 800 1600

SCALE IN FEET

ALTERNATIVE 9

GROUNDWATER CONTAINMENT OF CENTER AND VALLEY PLUMES

CROSSLEY FARM

HEREFORD TOWNSHIP, BERKS COUNTY, PA

FIGURE 15

X. COMPARATIVE EVALUATION OF ALTERNATIVES

In selecting EPA's Preferred Alternative EPA evaluates each proposed remedy against the nine criteria specified in the National Contingency Plan ("NCP"). The alternative selected must first satisfy the threshold criteria. Next, the primary balancing criteria are used to weigh the tradeoffs or advantages and disadvantages of each of the alternatives. Finally, after public comment has been obtained the modifying criteria are considered.

Below is a summary of the nine criteria used to evaluate the remedial alternatives.

Threshold Criteria:

Overall Protection of Human Health and the Environment:
Whether the remedy provides adequate protection and how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

Alternative 1 provides no protection for human health and the environment. Alternative 2 provides protection for drinking water wells by prohibiting the use of groundwater for drinking use, unless the water is treated to meet the drinking water standards. However, this alternative alone will not permanently restore the entire groundwater aquifer to protective levels. All the other alternatives including Alternative 6 will provide some level of protection for human health and the environment. By reducing the level of contamination in the hot-spot and monitoring the surrounding groundwater and springs it should provide protection for the environment, but none of these alternatives provide for capture of the entire contaminated groundwater plume

Compliance with ARARs:
Whether or not a remedy will meet all applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental statutes and/or whether there are grounds for invoking a waiver. Whether or not the remedy complies with advisories, criteria and/or guidance that may be relevant.

Alternative 1 does not comply with any ARARs. Alternative 2 would not comply with federal and state groundwater quality standards or statutory requirements. However the institutional controls requiring that the homes equipped with point of entry treatment systems will comply with MCLs, only at the point of consumption, but not throughout the aquifer. The remaining groundwater extraction and treatment alternatives will comply with ARARs only in the area of the groundwater capture zone.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence:

The ability of the remedy to afford long term, effective and permanent protection to human health and the environment along with the degree of certainty that the alternative will prove successful.

Alternative 1 provides no protection for human exposures. Alternative 2 provides a long term effective and permanent solution for drinking water wells by prohibiting the use of groundwater for drinking use, unless the water is treated to meet the drinking water standards. However, this alternative alone will not permanently restore the entire groundwater aquifer to protective levels. All the other alternatives including Alternative 6 will provide some long term effectiveness and permanence for the areas which the extraction and treatment systems are used, but none of these alternatives provide for capture of the entire contaminated groundwater plume

Reduction of Toxicity, Mobility or Volume:
The extent to which the alternative will reduce the toxicity, mobility, or volume of the contaminants causing the site risks.

Alternatives 1 and 2 provide no reduction in toxicity, mobility or volume. The remaining alternatives provide limited reduction in toxicity, mobility and volume in the area of the groundwater capture zone. Alternative 6 is capturing from the hot-spot area. Alternatives 3 and 4 capture the area at the top of Blackhead Hill. Alternative 5 would achieve limited reduction of contamination by the chemical oxidation process. Alternatives 7 and 8 would have a limited impact in the valley portion of the plume and Alternative 9 would capture some of the contamination at the top of the hill and in the valley.

Short Term Effectiveness:
The time until protection is achieved and the short term risk or impact to the community, onsite workers and the environment that may be posed during the construction and implementation of the alternative.

Alternative 1 provides no short term effectiveness. Alternative 2 provides a long term effective and permanent solution for drinking water wells by prohibiting the use of groundwater for drinking use, unless the water is treated to meet the drinking water standards. However, this alternative alone will not provide any short term effectiveness for the aquifer. All the other alternatives including Alternative 6 will provide some short term effectiveness for the areas which the extraction and treatment systems are used, but none of these alternative provides for capture of the entire contaminated groundwater plume.

Implementability:
The technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement that remedy.

All the alternatives can be implemented. The type of treatment described for Alternatives 3, 4, 6, 8, and 9 has been used before and can work for this Site even at the high concentration of TCE observed. The use of chemical oxidation is also implementable but the exact effect of the regional aquifer and the nearby residential wells is not easily predicted. Alternatives 7, 8 and 9 will need to use private property for placement of the treatment systems and may be somewhat difficult to construct.

Cost:
Includes estimated capital, operation and maintenance (O&M), and net present worth costs.

The capital cost is zero for Alternative 1. Capital costs are less than $20,000 for the monitoring program under Alternative 2. The remaining alternatives range from $3,000,000 to $10,000,000 for capital costs and the 30 year estimates of present worth costs are approximately double the capital costs. Alternative 6, the limited groundwater extraction and treatment alternative provides a cost effective solution for evaluating the capability of the extraction and treatment system and provides the possibility for expansion .

Modifying Criteria

State Acceptance:
The Commonwealth of Pennsylvania Department of Environmental Protection agrees with the selected remedy which will implement a limited extraction and treatment groundwater remediation.

The flexibility to expand the system to capture the groundwater plume moving down the west side of Blackhead Hill is an important concern for PADEP because the surface springs are contributing to the West Branch of the Perkiomen Creek where TCE concentrations exceed water quality criteria for human health.

Community Acceptance:
Community acceptance of the selected remedy will be described in the Responsiveness Summary contained in this ROD.

Generally the community was supportive of all the alternatives using the air stripping treatment technology to reduce the concentrations of contaminated groundwater, but were not interested in the chemical oxidation process. Alternative 1was unacceptable to the community and Alternative 2 was not acceptable as the only alternative for the long term remediation.

The following tables address the threshold criteria and the primary balancing criteria. Additional narrative analysis of the criteria is in the Feasibility Study for the Site.

TABLE ROD - 1
COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES
FEASIBILITY STUDY
CROSSLEY FARM SITE, HEREFORD TOWNSHIP, BERKS COUNTY, PA

ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 INSTITUTIONAL CONTROLS AND MONITORING	ALTERNATIVE 3 CONTAIN, TREAT AND ON-SITE RECHARGE	ALTERNATIVE 4 CONTAIN, TREAT AND OFF-SITE RECHARGE	ALTERNATIVE 5 IN-SITU TREATMENT OF RESIDUAL/HOT SPOT PLUME	ALTERNATIVE 6 RESIDUAL/HOT SPOT PLUME PUMP AND TREAT, ON-SITE RECHARGE	ALTERNATIVE 7 GROUNDWATER CONTAINMENT OF VALLEY PLUME, ON-SITE TREAT AND OFF-SITE DISCHARGE	ALTERNATIVE 8 IN-SITU TREATMENT OF VALLEY PLUME	ALTERNATIVE 9 CONTAINMENT OF CENTER OF PLUME AND VALLEY PLUME, TREAT AND OFF-SITE DISCHARGE
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT								
Provides no additional protection against human exposure to contaminated groundwater. Carcinogenic and non-carcinogenic risks exceeding EPA's target risk range would remain. No institutional controls to restrict use of untreated contaminated site groundwater . No actions taken to reduce contaminant migration.	Institutional controls would minimize potential exposure to site groundwater by prohibiting its use as drinking water. Groundwater monitoring would provide information regarding extent and concentration of contaminant plumes. No additional protection provided to environmental receptors.	Over time will prevent exposure to TCE concentrations greater than 1,000 ug/l downgradient of site. Institutional controls would minimize potential exposure to site groundwater. Monitoring would provide information regarding performance of remedial alternative and extent of untreated portion of site plume.	Same as Alternative 3.	Provides in-situ treatment of possible DNAPL source area. Natural degradation may reduce downgradient groundwater contaminant concentrations on-site and off-site, though over an extended period of time. Institutional controls and monitoring same as Alternative 3.	Provides collection and ex-situ treatment of possible DNAPL source area. Treated water would be returned on-site. Natural degradation may reduce groundwater contaminant concentrations on-site and off-site, though over an extended time period. Institutional controls and monitoring same as Alternative 3.	Would provide limited protection as majority of on-site and off-site plumes would not be contained and/or treated. Would provide collection and treatment of a portion of valley plume. Institutional controls and monitoring same as Alternative 3.	Same as Alternative 7, however treatment may not reduce contaminant levels to below MCLs.	Would provide higher level of protection as groundwater contaminated with TCE >1,000 ug/l on Blackhead Hill and in Dale Valley would be captured and treated. Institutional controls and monitoring same as Alternative 3.

ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 INSTITUTIONAL CONTROLS AND MONITORING	ALTERNATIVE 3 CONTAIN, TREAT AND ON-SITE RECHARGE	ALTERNATIVE 4 CONTAIN, TREAT AND OFF-SITE RECHARGE	ALTERNATIVE 5 IN-SITU TREATMENT OF RESIDUAL/HOT SPOT PLUME	ALTERNATIVE 6 RESIDUAL/HOT SPOT PLUME PUMP AND TREAT, ON-SITE RECHARGE	ALTERNATIVE 7 GROUNDWATER CONTAINMENT OF VALLEY PLUME, ON-SITE TREAT AND OFF-SITE DISCHARGE	ALTERNATIVE 8 IN-SITU TREATMENT OF VALLEY PLUME	ALTERNATIVE 9 CONTAINMENT OF CENTER OF PLUME AND VALLEY PLUME, TREAT AND OFF-SITE DISCHARGE
COMPLIANCE WITH ARARs AND TBCs								
Would not comply with federal and state groundwater quality standards or statutory requirements.	Would not comply with federal and state groundwater quality standards or statutory requirements. Would comply with drinking water standards at the point *sources equipped* with water treatment systems.	Implementation of this alternative would result in containment and treatment of TCE dissolved plume of 1,000 ug/l or greater concentration. Treatment would achieve ARAR for captured groundwater, only. On-site and off-site TCE plumes less than 1,000 ug/l would not comply, though over extended time period concentrations should decrease.	Same as Alternative 3.	Dissolved plume would not comply; over time residual source would be removed; dissolved plume concentrations should decrease.	Same as Alternative 5. Extent of untreated portion of site plume would not be in immediate compliance.	On-site dissolved and residual groundwater plume concentrations would not be in compliance. Groundwater downgradient of valley treatment zone should comply over time.	Same as Alternative 7.	Would result in containment and treatment of TCE plume >1,000 ug/l. Lower concentration plumes should comply over time.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT								
No reduction of toxicity, mobility, or volume, since no treatment would be employed.	Same as Alternative 1.	The groundwater extraction and treatment system would capture a portion of the dissolved plume and remove the VOCs to reduce the toxicity, mobility and volume of contaminated groundwater. The number of years of treatment to reduce on-site levels below ARARs is unknown. Treatment process is irreversible.	Same as Alternative 3.	The toxicity and volume of untreated groundwater within the residual zone would be reduced through implementation of Alternative 5. The degree of reduction is unknown. Treatment process is *irreversible*.	Same as Alternatives 5.	The toxicity and volume of groundwater within the valley plume would be reduced. Preliminary design would treat 2,400 gpm. Mobility of plume not affected. Treatment process is irreversible.	Same as Alternative 7.	Same as Alternative 3 and 7.

ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 INSTITUTIONAL CONTROLS AND MONITORING	ALTERNATIVE 3 CONTAIN, TREAT AND ON-SITE RECHARGE	ALTERNATIVE 4 CONTAIN, TREAT AND OFF-SITE RECHARGE	ALTERNATIVE 5 IN-SITU TREATMENT OF RESIDUAL/HOT SPOT PLUME	ALTERNATIVE 6 RESIDUAL/HOT SPOT PLUME PUMP AND TREAT, ON-SITE RECHARGE	ALTERNATIVE 7 GROUNDWATER CONTAINMENT OF VALLEY PLUME, ON-SITE TREAT AND OFF-SITE DISCHARGE	ALTERNATIVE 8 IN-SITU TREATMENT OF VALLEY PLUME	ALTERNATIVE 9 CONTAINMENT OF CENTER OF PLUME AND VALLEY PLUME, TREAT AND OFF-SITE DISCHARGE
LONG-TERM EFFECTIVENESS AND PERMANENCE								
Existing risks would remain. Five-year reviews would be required since groundwater contaminants would be left in place.	Implementation and enforcement of institutional controls would reduce risks from exposure to on-site groundwater. Risks to off-site untreated groundwater would remain. Five-year reviews would be required since groundwater contaminants would be left in place.	Over an extended period, until groundwater remediation goals are achieved and natural degradation reduces untreated portion of plume, implementation and enforcement of institutional controls would reduce risks from exposure to a portion of the groundwater plume. Technologies are widely used and effective for remediation of VOC contaminated groundwater. Five-year reviews would be required as a portion of the plume would not be treated.	Same as Alternative 3.	Over time, risk at site would decrease as source of contamination would be removed; however dissolved plume not treated. Relatively new treatment process, may not be adequate for extent of DNAPL source area and contaminant levels; has had limited field applications. Five-year reviews would be required as portion of plume would not be treated.	Same as Alternative 3.	Risk at site would remain the same; risk downgradient of treatment zone would be reduced. Groundwater extraction and air stripping are widely used effective technologies for the remediation of VOC contaminated groundwater. Five-year reviews would be required as portion of plume would not be treated.	Relatively new treatment process, has had limited field applications. Adequacy of treatment is dependent upon effectiveness of reagent versus contaminant levels and geology of treatment area. Five-year reviews would be required as a portion of plume would not be remediated.	Same as Alternative 3.

ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 INSTITUTIONAL CONTROLS AND MONITORING	ALTERNATIVE 3 CONTAIN, TREAT AND ON-SITE RECHARGE	ALTERNATIVE 4 CONTAIN, TREAT AND OFF-SITE RECHARGE	ALTERNATIVE 5 IN-SITU TREATMENT OF RESIDUAL/HOT SPOT PLUME	ALTERNATIVE 6 RESIDUAL/HOT SPOT PLUME PUMP AND TREAT, ON-SITE RECHARGE	ALTERNATIVE 7 GROUNDWATER CONTAINMENT OF VALLEY PLUME, ON-SITE TREAT AND OFF-SITE DISCHARGE	ALTERNATIVE 8 IN-SITU TREATMENT OF VALLEY PLUME	ALTERNATIVE 9 CONTAINMENT OF CENTER OF PLUME AND VALLEY PLUME, TREAT AND OFF-SITE DISCHARGE
SHORT-TERM EFFECTIVENESS								
No risk to community, workers, or environment anticipated.	No significant risk to community or workers anticipated. No additional environmental impacts anticipated as remedial measures consist of institutional controls and monitoring. Would not meet RAO for preventing migration of contaminated groundwater.	No significant risk to community or environment is anticipated. Site-specific HASP would be developed and implemented for worker protection. Will result in portion of plume being contained and treated; untreated portion would continue to migrate from site. Duration of treatment unknown.	Same as Alternative 3.	Risk to community should be minimal, however, additional information on bedrock fracture network and treatment process chemistry required. Site-specific HASP would be developed and implemented for worker protection. Need to identify engineering controls required to minimize environmental effects. Duration of treatment is unknown. Untreated portion of plume would continue to migrate from site.	No significant risk to community or environment anticipated. Site-specific HASP would be developed and implemented for worker protection. Would not achieve RAO for preventing migration of contaminated groundwater as only a portion of the plume would be treated. Need to quantify source mass to determine duration of treatment.	Same as Alternative 3. Addresses a portion of the valley plume; does not address migration of site plume or source removal.	Risk to community should be minimal, however, additional information on aquifer characteristics, bedrock fracture network, and treatment process chemistry required prior to implementation. Site-specific HASP would be developed and implemented for worker protection during construction, operation, and monitoring.	Same as Alternative 3.
IMPLEMENTABILITY								
No construction or operation involved.	Same as Alternative 1.	Common well construction techniques and equipment used for installation of extraction and containment system. Modular treatment system would be easily constructed. Recharge system installation/operation may be difficult due to site topography, land access and geology.	Common well construction techniques and equipment used for installation of extraction and containment system. Modular treatment system would be easily constructed. Installation and construction of off-site treated water discharge line will require access to private properties.	More difficult to construct and operate than Alternative 6; large number of wells required to inject treatment materials.	Common construction techniques and equipment used for installation of extraction and containment system. Modular treatment system would be easily constructed. Recharge system installation may be difficult operation due to site topography, land access and geology.	Common construction techniques and equipment used for installation of extraction and containment system. Modular treatment system would be easily constructed. Installation and construction of treatment system and discharge line will require access to private properties.	More difficult to construct and operate than Alternative 7, large number of wells required for injection of treatment materials. Installation and construction of treatment system will require access to private properties.	Same as Alternative 4 and 7.

	ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 INSTITUTIONAL CONTROLS AND MONITORING	ALTERNATIVE 3 CONTAIN, TREAT AND ON-SITE RECHARGE	ALTERNATIVE 4 CONTAIN, TREAT AND OFF-SITE RECHARGE	ALTERNATIVE 5 IN-SITU TREATMENT OF RESIDUAL/HOT SPOT PLUME	ALTERNATIVE 6 RESIDUAL/HOT SPOT PLUME PUMP & TREAT, ON-SITE RECHARGE	ALTERNATIVE 7 GROUNDWATER CONTAINMENT OF VALLEY PLUME, ON-SITE TREAT AND OFF-SITE DISCHARGE	ALTERNATIVE 8 IN-SITU TREATMENT OF VALLEY PLUME	ALTERNATIVE 9 CONTAINMENT OF CENTER OF PLUME AND VALLEY PLUME, TREAT AND OFF-SITE DISCHARGE
	COST								
Capital Cost	$0	$16,074	$6,704,932	$6,339,215	$7,593,660	$3,607,300	$5,366,997	$8,012,805	$10,250,770
First Year Annual O&M Cost	$0	$21,900	$2,258,976	$2,256,429	$21,900	$1,164,872	$223,120	$1,437,500	$2,256,429
Present Worth Cost[1]	$0	$581,148	$14,609,180	$14,211,857	$8,212,634	$8,649,466	$8,627,074	$26,469,716	$20,818,415
	STATE ACCEPTANCE								
	Not acceptable	Not acceptable	Acceptable	Acceptable	Not Acceptable	Acceptable	Acceptable	Not Acceptable	Acceptable
	COMMUNITY ACCEPTANCE								
	Not acceptable	Not acceptable	Acceptable	Acceptable	Not Acceptable	Acceptable	Acceptable	Not Acceptable	Acceptable

[1] Present worth calculated over a 30 year period at a 7% discount rate per EPA OSWER #9355.3-20 and #9355.0-75

XI. PRINCIPAL THREAT WASTES

The NCP (Section 300.430(a)(1)(iii)(A)) establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. The principal threat concept is applied to the characterization of "source materials" at a Superfund Site. A source material includes or contains hazardous substances, pollutant or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, based on the concentrations found, the high probability that DNAPLs are present at the Crossley Farm Site in the fractured bedrock may be viewed as a source material.

At this Site the principal threat wastes including trichloroethylene (190 mg/l), tetrachloroethylene (6 mg/l) and cis-1,2-dichloroethylene (.28 mg/l) would present a significant risk to human health should exposure occur. The selected remedy will address the statutory preference for treatment as a principal element in the area where the highest concentrations occur. By decreasing the "hot spot" concentrations, the source of contamination will decrease over time. The selected remedy will treat the contaminated groundwater source and monitor the migration of contamination from the source area.

XII. SELECTED REMEDY AND PERFORMANCE STANDARDS

A. *Summary of the Rationale for the Selected Remedy*

CERCLA requires that any remedy selected to address contamination at a hazardous waste site must be protective of public health, welfare, and the environment, be cost-effective, in compliance with regulatory and statutory provisions that are applicable or relevant and appropriate requirements, and consistent with the NCP to the extent practicable. CERCLA also expresses a preference for permanent solutions, for treating hazardous substances on-site, and for applying alternative or innovative technologies.

This remedy is proposed as an interim action to begin the massive and complex task of cleaning up the groundwater contamination problem originating at the top of Blackhead Hill with concentrations as high as 190,000 ug/l. This action will address only the "hot spot" located in the borrow pit area and will be used to measure and define the ability of a groundwater extraction and treatment system to reduce the highest concentration.

This interim remedial action is not a final decision on the regional groundwater cleanup. If extraction and treatment in the "hot spot" is successful in reducing concentrations at the top of the hill and in the springs located on the hill and in the valley, the proposed remedy can be expanded through a separate EPA decision document to become a larger network of extraction wells to remove more contaminated groundwater from the fractured bedrock.

This remedial action is only for groundwater. The evaluation of the soil did not show remaining soil concentrations which would impact the already contaminated groundwater. The evaluation of surface water shows elevated concentration in the discharge of several springs, but the treatment of groundwater should reduce the concentration in the springs. The sediment evaluation did not show any excessive risks for human health or wildlife in the vicinity of the site.

This remedy will be for a second operable unit (OU2) to treat groundwater. The current point of entry treatment systems established as the interim remedy for drinking water in OU 1 will remain in effect for existing homes and will not be changed by this remedy for the groundwater remedial action. EPA will continue to monitor the individual wells and springs as outlined in the 1997 Record of Decision for OU 1.

For the purpose of this ROD, "existing home" means any residence which has received a local building permit prior to March 1, 2001; most but not all of these homes are identified in Appendix H of the RI report for this operable unit.

Based on the information currently available, the lead agency believes the selected remedy meets the threshold criteria with the a goal of meeting EPA' Drinking Water Standards and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the selected remedy in conjunction with the previous actions taken by EPA and PADEP to satisfy the following statutory requirements of CERCLA Section 121(b): (1) be protective of human health and the environment, (2) be cost effective, and (3) satisfy preference for treatment as a principal element. This interim remedy is not required to meet ARARS because it is not the final remedy decision. The final and permanent remedy decision in regard to the regional groundwater remediation shall be made by EPA in a separate decision document following the evaluation of the interim remedy.

B. Compliance with ARARs

The selected remedy will comply with ARARs pertinent to the remedial action for groundwater extraction and treatment. ARARs that apply to this remedy are the following chemical specific and action specific requirements.

Chemical-Specific ARARs

Chemical specific ARARs apply to the hot spot area groundwater and are as follows:

1. Safe Water Drinking Act (SWDA) - Maximum Contaminant Levels (MCLs) (40 - CFR-141)

The applicable chemical specific concentrations in the hot spot area are:

a. cis-1,2- dichloroethylene	0.07 mg/l
b. Tetrachloroethylene	0.005 mg/l
c. Trichloroethylene	0.005 mg/l

Action-Specific ARARs

The action specific ARARs apply to the following four components of the selected remedy:

2. Groundwater monitoring will be implemented in a manner consistent with 25 Pa. Code Chapter 264, Subchapter F.

3. The groundwater collection and treatment operations will constitute treatment of groundwater containing hazardous substances, and may result in the generation of hazardous wastes. Therefore a determination must be made if any materials derived from the treatment of the contaminated groundwater (i.e., spent carbon from carbon adsorption of vapors and sludge generated during treatment). If any of these materials meet the characteristic requirements for a hazardous waste, the remedy will be implemented in a manner consistent with the requirements of 25 Pa. Code Chapter 262, Subparts A (relating to hazardous waste determination and identification numbers), B (relating to manifesting requirements of off-site shipments of spent carbon or other hazardous wastes), and C (relating to pre-transport requirements): 25 Pa. Code 263 (relating to transporters of hazardous wastes); and with respect to the operations at the Site generally, with the substantive requirements of Pa. Code Chapter 264, Subparts B-D, I (in the event that hazardous waste generated is managed in containers) and 25 Pa. Code, Subpart J (in the event that hazardous waste is managed, treated or stored in tanks). The remedy will also be implemented in a manner consistent with 25 Pa. Code Part 268, Section 268.40 (regarding prohibitions on land disposal and prohibitions on storage of hazardous waste).

4. The on-site treatment of contaminated groundwater using the air-stripping technology will be implemented in a manner consistent with the following:

   Federal Clean Air Act requirements, 42 U.S.C. Sections 7401 et seq., are applicable and must be met for the discharge of contaminants to the air. The Pennsylvania Air Pollution Control Act is also applicable, as are Pennsylvania's Air Pollution Control Requirements, 25 Pa. Code, Chapters 121-142.

   The requirements of Subpart AA (Air Emission Standards for Process Vents) of the Federal Resource Conservation and Recovery Act (RCRA) regulations set forth at 40 C.F.R. Part 264 are relevant and appropriate and, depending on the levels of organics in the extracted groundwater and treatment residuals, may be applicable to the air

stripping operations conducted as part of the selected remedy. These regulations require that total organic emissions from the air stripping process vents must be less than 1.4 kg/hr (3lb/hr) and 2800 kg/yr (3.1 tons/yr).

25 Pa. Code, Section 127.12(a)(5) will apply if any new point source air emissions result from implementation of the selected remedy. These Commonwealth of Pennsylvania regulations require that emissions be reduced to the minimum obtainable levels through the use of best available technology (BAT) as defined in 25 Pa. Code, Section 121.1.

The substantive requirements of 25 Pa. Code, Section 127.11 will apply to the selected remedy if additional air stripping units are required. The Commonwealth of Pennsylvania regulations require a plan for approval for most air stripping and soil venting/decontamination projects designed to remove volatile contaminants from soil, water and other materials.

5. Injection of treated groundwater is regulated and monitored by the EPA Underground Injection Control Program (UIC) under C.F.R. Part 144. This applies to the trenching or reinjection phase of the remedy. Requirements are that the action cannot endanger human health or the environment and that the action must be reported to EPA's Region 3 UIC program.

C. Description of the Selected Remedy / Residual Hot-Spot Plume Pumping and On-Site Treatment

1. The selected remedy is to implement a limited groundwater treatment remedial action for the highest concentration of contamination at the top of Blackhead Hill, the approximate location is depicted in Figure 12 on page 29. By using a limited number of extraction wells in the "hot spot", the Agency can evaluate the effectiveness of a few wells to decrease concentrations in the groundwater and in the springs down the hill and in the valley. This approach will allow for expansion of the extraction and treatment system as EPA considers which other remedial actions to select in future decision documents for the Site. The expansion could be similar to and include other alternatives described in the Feasibility Study to contain the contamination at the top of the hill and possibly locate additional groundwater treatment systems downgradient in the valley .

This Remedial Alternative will provide treatment of the highest concentration of trichloroethylene (TCE) contamination located immediately downgradient of the borrow pit area using a limited number of extraction wells in the area represented by concentrations above 10^5 or 100,000 ug/l of TCE.

This remedy proposes installation of approximately ten wells in the highest concentration area at depths of approximately 125 and 400 feet to be pumped at a rate of 5 to 30 gallons per minute (gpm).

2. This alternative will require additional groundwater sampling to better delineate the vertical and horizontal extent of contamination and to visually determine if the Dense NonAqueous Phase Liquid (DNAPL) exists. This will be further determined in a remedial design.

3. Groundwater treatment will be at an on-site plant using an air stripping process to transfer the volatile compounds from the groundwater to a vapor phase which can be captured in an off-gas treatment system. The treated water will be run through an additional carbon polishing unit prior to discharge.

4. The recharge system for groundwater would be constructed to discharge the water into the shallow and intermediate aquifer by pumping the treated water to specifically constructed trenches in the wooded areas of the farm or into wells screened in the shallow and intermediate water bearing zones. This will be further determined in a remedial design.

5. This proposed remedial action will require some property on the farm at the top of the hill for long term use to house the equipment for the extraction and treatment remedy as well as for the groundwater recharge system. It will be further determined in a remedial design.,

6. The institutional controls would be to monitor the groundwater and restrict the use of contaminated groundwater at the Site.

   Groundwater extraction wells shall not be installed and contaminated groundwater at the Crossley Farm Superfund Site, including but not limited to the areas of Huff's Church Road, Dale Road, Forgedale Road, Dairy Lane, Airport Road and Camp Mench Mill Road shall not be used unless treatment units are installed and maintained to ensure that any water used has contaminant levels at or below MCLs. This could be achieved with local government restrictions on the use of groundwater.

7. The June 1997 ROD is now complete and the Pennsylvania Department of Environmental Protection has assumed responsibility for the operation and maintenance of the treatment units installed under that remedial action. Therefore, any new property construction over the contaminated groundwater plume after February 2001 would not receive carbon filtration units paid for by EPA.

8. Groundwater monitoring under this remedy is a remedial action. Sampling of residential wells and springs will be conducted every 6 months.

9. This remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, Pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c), a statutory review by EPA will be conducted no less often than every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

D. Summary of Estimated Remedy Costs

The information in the cost estimate summary table is based on the best available information regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences ("ESD"), or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. The estimated capital, O&M, and present worth costs for all the Alternatives are provided in the Comparative Evaluation of Alternatives Table on page 51. The estimated capital costs are $3,607,300, O&M costs are $1,164,872, and present worth costs for the selected remedy are $8,649,466.

E. Expected Outcomes of the Selected Remedy

Since the selected remedy is only a limited area groundwater extraction and treatment remedial action for the highest concentration of contamination at the top of Blackhead Hill, the expectation is to reduce the contamination at the top of the hill and to achieve the Maximum Contaminant Levels (MCLs) allowed under the National Primary Drinking Water Regulations. This is an interim measure as described above. By using a limited number of extraction wells in the "hot spot" at the top of Blackhead Hill, the Agency can evaluate the effectiveness of a few wells to decrease concentrations in the groundwater and in the springs down the hill and in the valley. This interim remedial action is not a final decision on the regional groundwater cleanup. If extraction and treatment in the "hot spot" is successful, the proposed remedy can be expanded through a separate EPA decision document to become a larger network of extraction wells to remove more contaminated groundwater from the fractured bedrock.

The institutional controls to restrict groundwater use unless the owner of new construction meets the performance standards and the MCLs will have an effect on future land use in the area. The requirement to protect the public health is essential for any exposures and is not prohibitive for new construction.

The monitoring program will continue to evaluate the groundwater contamination and the point of entry treatment units will be provided to any existing residence as provided in the Record of Decision for the First Operable Unit.

F. Performance Standards

1. Groundwater Remediation Standards for the hot-spot area shall meet contaminant levels at or below Maximum Contaminant Levels (MCLs) for the following:

a. cis-1,2- dichloroethylene	0.07 mg/l
b. Tetrachloroethylene	0.005 mg/l
c. Trichloroethylene	0.005 mg/l

2. Institutional Controls

   Groundwater extraction wells shall not be installed and groundwater contaminated above the standards identified in #1 above shall not be extracted or used at the Crossley Farm Superfund Site unless treatment units are installed and maintained to ensure that any water used has contaminant levels at or below MCLs.

3. Hazardous Substance Delineation

   Fully delineate to the extent practicable the vertical and horizontal extent of contamination and visually determine if the DNAPL exists.

4. Treatment System

   Groundwater shall be treated to achieve MCLs listed in #1 above at an on-site plant using an air stripping process to transfer the volatile compounds from the groundwater to a vapor phase which will be captured in an off-gas treatment system. The treated water will be run through an additional carbon polishing unit prior to discharge into the recharge system.

5. Recharge System

   The treated water shall be recharged into the shallow and intermediate aquifer by pumping to specifically constructed trenches or into wells screened in the shallow and intermediate water bearing zones on the Site.

6. Groundwater Monitoring

   Groundwater monitoring of residential wells and springs shall be conducted every six months to detect the presence of TCE and other organic compounds related to the Site.

XIII. STATUTORY DETERMINATIONS

Under section 121 of CERCLA and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy will adequately protect human health and the environment through treatment and/or institutional controls. Specifically the remedy will reduce the concentrations in the "hot spot" and control the use of contaminated groundwater by providing carbon filtration units to existing homeowners at the Site. New construction of wells will have to meet the Drinking Water Standards.

Compliance with and Attainment of Applicable or Relevant and Appropriate Requirements

The selected remedy alternative is to implement a limited area groundwater extraction and treatment remedial action for the highest concentration of contamination at the top of Blackhead Hill to achieve the Maximum Contaminant Levels (MCLs) allowed under the National Primary Drinking Water Regulations.

This is an interim measure and is further described with more details above. By using a limited number of extraction wells in the "hot spot" at the top of Blackhead Hill, the Agency can evaluate the effectiveness of a few wells to decrease concentrations in the groundwater and in the springs down the hill and in the valley. This interim remedial action is not a final decision on the regional groundwater cleanup. If extraction and treatment in the "hot spot" is successful, the proposed remedy can be expanded through a separate EPA decision document to become a larger network of extraction wells to remove more contaminated groundwater from the fractured bedrock.

This interim remedy is not required to meet ARARs because it is not the final remedy decision. The final and permanent remedy decision in regard to the regional groundwater remediation shall be made by EPA in a separate decision document following the evaluation of the interim remedy.

Cost-effectiveness

The selected remedy is cost effective because of the limited approach to extraction and treatment and then the evaluation of the effectiveness in reducing concentrations in the "hot spot" and in the springs before expansion of the system is considered.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

As an interim remedy the implementation of the groundwater and extraction treatment is a permanent remedy with the possibility of expansion to the maximum extent practicable for the fractured groundwater aquifer.

Preference for Treatment as a Principal Element

The selected remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Five -Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, Pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c), a statutory review by EPA will be conducted no less often than every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

PART III

RESPONSIVENESS SUMMARY FOR THE PROPOSED REMEDIAL ACTION PLAN

AT THE

CROSSLEY FARM SUPERFUND SITE

Washington Township, PA

Public Comment Period: July 23, 2001 - August 30, 2001

At the August 7, 2001 public meeting, representatives from EPA answered questions about the Site and the remedial alternatives under consideration. Approximately 50 people attended the meeting, including residents from the impacted area and news media representatives.

Another meeting was held on August 21, 2001 at the request of the Hereford Township Supervisors to coincide with their regularly scheduled Supervisors meeting. An EPA representative presented the proposed clean up alternative and answered questions.

The most important issue was questions about EPA's decision to require any property owners beginning new construction to test their own well and provide their own treatment systems to meet safe drinking water standards.

1. Question: In the future, who will get water treatment systems?

EPA will provide filtration systems to the existing homes that are contaminated above the drinking water standards included in the performance standards in the Record of Decision and are known to be from the Crossley Farm Site. For the purpose of this ROD, "existing home" means any residence which has received a local building permit prior to March 1, 2001.

Because the June 1997 ROD is now complete, as discussed above, any new property construction is subject to the institutional controls identified in this ROD. Specifically, groundwater extraction wells shall not be installed and groundwater contaminated above the MCL standards identified shall not be extracted or used at the Crossley Farm Superfund Site unless treatment units are installed and maintained to ensure that any water used has contaminant levels at or below MCLs. Therefore, if a new building permit is issued for construction after March 1, 2001, EPA will not provide the treatment unit at the government's expense. It would be inappropriate for EPA to take the role of promoting and supporting development in the areas that are know to have contaminated groundwater.

The following example from one participant at the meeting was typical of others in the meeting.

> "I have been building a house for 6 years and am ready to install my well system. At the last meeting I had asked if my well, once installed, would have the treatment system provided by the responsible agency, and was told to contact you about testing to determine the levels of contamination. The latest letter states that new construction (after Feb 2001) will not receive carbon units paid for by and maintained by the ...
>
> Since I started construction over 6 years ago, but am just installing my well now, I would like to know how my system will be handled.
>
> I also do not believe there should be a time limit on this matter, to protect the local property owners from pollution caused by some unnamed industry. Until the levels of

contamination are restored back to normal amounts the EPA has a responsibility to the public to provide safe drinking water."

This home builder would receive a filtration system if his well is contaminated from the Site at levels above the MCLs identified, because he had received a building permit prior to March 1, 2001. Any new filtration systems installed by EPA will be monitored for effectiveness for one year. Following the first year, the operation and maintenance will be the responsibility of the Pennsylvania Department of Environmental Protection.

In the case of a property owner who chooses to build new construction on their property where no building permit was issued as of March 1, 2001, EPA will not make exceptions to the new construction decision as presented in the Record of Decision. EPA will limit new treatment units to the existing buildings and will not provide for new construction, for the reasons identified above.

2. Question: How is EPA notifying the community and prospective purchasers?

These public meetings in conjunction with information provided to the local municipalities (township and county) are the best avenue available to EPA to provide notification to any prospective purchasers and to any new construction activities. EPA will not be able to oversee or interfere with a property owner's decision to subdivide and sell properties in the townships or the county. However, the institutional controls in this ROD restricting groundwater use, as a matter of public health, will apply to that property.

EPA will continue to monitor home wells every six months and any new well drilled and developed in the area of the remedial action monitoring program may be evaluated as a monitoring point for the regional aquifer. All analytical information will be provided to the owner.

3. Question: Will the proposed treatment technology work and what are the long term plans for clean up of the regional groundwater/

EPA believes that the selected treatment technology will work. Air strippers have been used at many sites for treatment of groundwater contaminated with volatile organic compounds. TCE and PCE will be removed from the water medium to the air medium and will be captured in a carbon unit, prior to the release of the treated air to the atmosphere.

EPA will constantly review the treatment process and evaluate each set of sampling and analysis on the monitoring wells, the springs and the residential wells. It is anticipated that this will occur every six months. Based on any observed trends or data gaps, EPA can certainly make a decision to expand the area for groundwater extraction and treatment at any time, but that decision may require a new decision document and possibly a public comment period.

4. Question: What are the toxic effects of trichloroethylene (TCE)?

TCE affects the nervous system. Inhalation exposure to very high levels for short times has caused unconsciousness and death. People who breathe moderate levels may have headaches, dizziness, or impaired ability to perform. Skin contact with high levels can cause rashes. Long-term exposure to TCE by the oral and inhalation routes may lead to liver, and kidney damage. TCE has also been associated with endocrine effects (e.g., altered testosterone levels) and several forms of cancers including kidney, liver, lung, lympho-hematopoietic, cervical, prostate, testicular and pancreatic cancer. TCE is also associated with developmental (e.g., cardiac and eye anomalies) and reproductive effects (e.g., low sperm count).

5. Question: What is going on with the ATSDR Health Registry?

EPA did provide the contacts in the regional office and the ATSDR web site can be reached at www.atsdr.cdc.gov; national exposure registry; registrant reports; TCE sub registry. Current information from their web site is attached.

CONTENTS

National Exposure Registries

Trichloroethylene (TCE) Subregistry

Baseline through Followup 3

Registrant Report

The Agency for Toxic Substances and Disease Registry (ATSDR) started the Trichloroethylene (TCE) Subregistry in 1989 as part of the National Exposure Registry (NER). The goal of the TCE Subregistry is to collect and provide information that will help ATSDR explore any possible links between exposure to TCE and health problems and to keep registrants informed of all current information related to their TCE exposure. Information from the first (Baseline) interview with subregistry members (registrants) was reported to you in the spring of 1993. In 1996, ATSDR reported the findings for the Followup 1 interviews.

This report summarizes results reported in the *TCE Baseline Through Followup 3 Technical Report*, which provides detailed information on the survey methods and results from the first four sets of interviews: Baseline, Followup 1, Followup 2, and Followup 3. These interviews were conducted between 1989 and 1995 at different times for each of the 14 sites in five states. In addition, this report updates information contained in the registrant reports for the Baseline and Followup 1 interviews by including the results of these interviews at two new sites. The full report is available at locations listed in the cover letter.

Who are the registrants?

Registrants are persons who were exposed to TCE at 14 sites in five (5) states: Michigan, Illinois, Indiana, Arizona, and Pennsylvania. The majority (over 90%) reside in the north central United States. Information about registrants who participated in each interview is presented below.

	Interview Time Frame			
Registrant Characteristics	**Baseline**	**Followup 1**	**Followup 2**	**Followup 3**
Living registrants (No.)	4172	3688	3187	2815
Deceased registrants (No.)	317	26	44	45
Females (%)	52.0%	52.6%	53.3%	54.3%
Current or ex-smokers (%)	60.4%	58.6%	58.2%	56.9%

Note: numbers in this table are based on completed interviews at each time point.

What were the results?

Like the previous Baseline and Followup 1 reports, the health conditions reported by TCE registrants at each interview were compared with the health conditions reported by the general population in a nationwide survey. The results contained in this report are limited to registrants who reported their race as white because the number of people in other racial groups was too small to allow for meaningful analysis.

Registrants reported higher rates for certain health conditions when compared with the national survey, but the higher rates for some health conditions were not always reported at all of the interviews (Table 1). The higher reported rates were also not consistent by age and gender groups for all four (4) sets of interviews. Results and findings previously summarized in the Baseline and Followup 1 Registrant Reports may have changed due to the addition of data from the new registrants in Pennsylvania and Arizona. Also, it should be noted that the rates of all health conditions can change with time; thus, the comparisons with the national rates may also change. Overall, TCE registrants reported higher rates than the general population for certain health conditions at each interview as shown below. See Table 1 at the end of this report for details by age and sex.

Baseline	**Followup 1**	**Followup 2**	**Followup 3**
Anemia	Anemia	Anemia	Anemia
---	Diabetes	---	Diabetes
Hearing impairment	---	---	---
---	Hypertension	---	---
Kidney disease	---	---	---
---	Liver problems	Liver problems	Liver problems
Speech impairment	---	---	---
Skin rashes	Skin rashes	Skin rashes	Skin rashes
Stroke	Stroke	Stroke	Stroke
Urinary disorder	Urinary disorder	Urinary disorder	Urinary disorder

Does TCE in household water affect health?

Although registrants who were exposed to TCE in drinking water reported several health problems more frequently than the general U.S. population, the TCE Subregistry data cannot be used to determine if TCE "causes" health problems. The higher reported rates may be related to TCE exposure, but other factors might have contributed to these health problems. For example, both exposure to chemicals at work and lifestyle factors (such as smoking cigarettes and drinking alcohol) can affect health. Some health conditions can also be due to other illnesses. For instance, hearing loss can be related to ear infections.

To better understand the health conditions reported by TCE Subregistrants in this report, ATSDR needs more detailed health information. ATSDR staff members will be contacting registrants who reported having cancer to determine the exact type of cancer and whether other factors, if any, might be related to those conditions. A pilot validation study of cancer outcomes has been completed, and a separate report on cancer is in progress. An investigation of the higher reported incidence of hearing loss and speech impairment in children at the time of the baseline interview has been completed and these results will be available in 1999. Because of consistent excess reporting of these conditions by TCE registrants, more in-depth analyses of diabetes and anemia are ongoing, and additional questions about these two conditions will be asked at the next interview. Reports on the findings of all these studies will be shared with registrants.

What happens now?

ATSDR will continue to contact registrants to update TCE Subregistry files. Data from Followups 4 and 5 (including data collected in the fall of 1997) are being analyzed by ATSDR and should be provided to registrants in 2000. The time between updates is being increased from two years to three years, to reduce the time registrants spend answering questions while still enabling ATSDR to obtain valuable and timely information about registrants' health. The next series of interviews is scheduled to take place in the fall of 2000. The same questions that were asked in previous interviews will be included in this next follow-up, and some new questions may be added on the basis of the results of analyses of data already collected. The results of all future follow-ups will be shared with registrants.

What should the registrants do?

ATSDR does not have enough information about the health conditions reported by members of the TCE Subregistry to make medical recommendations for registrants that are different from those for the general public. If registrants have any concerns about their health, they should consult their personal doctors or other health care providers.

For information on this report or the *TCE Baseline Through Followup 3 Technical Report*, please call Dr. Je Anne Burg at 404-639-6202 or, toll-free, at 1-888-422-8737.

Summary of results of Baseline and Followups 1, 2, and 3 comparisons with NHIS

Disease Category	Age Groups (years)																	
	0-9		10-17		18-24		25-34		35-44		45-54		55-64		65		All	All
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Anemia and other blood disorders																		
Baseline	e		e			e			e			e	e		e		X	X
F1	X	X	X	X	X	X					X	X	X	X				
F2	e	e					e		e		e							X
F3	e	e							e		e	e	e	e	e			X
Diabetes																		
Baseline						e												
F1						e						X						
F2						e												
F3																		X
Speech Impairment, Hearing impairment,																		
Baseline	X	X																
F1																		
F2																		
F3																		
Kidney Disease																		
Baseline			e											X				
F1	e	e																
F2	e																	
F3					e													
Liver problems																		
Baseline	e					e						e		e				
F1					e		X		e			X		e				
F2			e			X	e					e		e		e		
F3			e							e				e				X
Skin rashes, eczema, other skin allergies																		
Baseline																		X
F1	X	X																
F2			X	X														
F3																		X
Stroke																		
Baseline				e						e	X		e					
F1				e		e		e		e	e		e					X
F2				e		e	e			e	e		e					X
F3				e		e	e				e							X
Urinary tract disorders																		
Baseline		X		X	X	X		X		X				X				

F1	X	X	X	X	X	X	X	X	X	X	X
F2	X	X	X		X		X	X	X	X	X
F3	X		X		X		X	X	X	X	X

F1: Followup 1 M: Male

F2: Followup 2 F: Female

F3: Followup 3

X = Statistically significant differences (i.e., rate for the TCE Subregistry group was significantly higher

e = TCE Subregistry higher than expected (observations/expected 2.5) but not statistically significant

This page last updated on July 03, 2000

Send e-mail to National Exposure Registry

Pennsylvania Department of Environmental Protection

909 Elmerton Avenue
Harrisburg, PA 17110-8200
September 26, 2001

717-705-4704
FAX 717-705-4930

Southcentral Regional Office

Mr. Abraham Ferdas, Director, 3HS00
Hazardous Waste Management Division
US EPA Region III
1650 Arch Street
Philadelphia, PA 19103

Re: Record of Decision
Crossley Farm Site
Hereford and Washington Townships
Berks County, Pennsylvania

Dear Mr. Ferdas:

The Department of Environmental Protection has reviewed the Record of Decision (ROD) for Crossley Farm Superfund Site, received September 19, 2001, togther with the revisions received September 25, 2001. This remedy will be a second operable unit to treat groundwater.

The selected remedy for this site consists of the following:

- Implementation of a limited groundwater treatment remedial action for the highest concentration at the top of Blackhead Hill, by using a limited number of extraction wells in the "Hot Spot". This Remedial Alternative will provide treatment of the highest concentration of trichloroethylene, and will allow for expansion of the extraction and treatment system as EPA considers which other remedial actions to select in future decision documents for the Site.

- This alternative will require additional groundwater sampling to better delineate the vertical and horizontal extent of contamination and to visually determine if the Dense Non-Aqueous Phase Liquid exists.

- Groundwater treatment will be at an on-site plant using an air stripping process to transfer the volatile compounds from the groundwater to a vapor phase which can be captured in an off-gas treatment system. The treated water will be run through an additional carbon polishing unit prior to discharge.

- The recharge system for groundwater would be constructed to discharge the water into the shallow and intermediate aquifer.

- This proposed remedial action will require some property on the farm at the top of the hill for long term use to house the equipment for the extraction and treatment remedy, as well as for the groundwater recharge system.

- Institutional controls would be implemented to monitor the groundwater and restrict the use of contaminated groundwater at the Site.

- Because the June 1997 ROD is now complete any new property construction over the contaminated groundwater plume after February 2001 would not receive carbon filtration units paid for by EPA.

- Groundwater monitoring under this remedy would be a remedial action. Sampling of residential wells and springs would be conducted every six months.

- This remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. Pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c), a statutory review by EPA will be conducted no less often than every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment

- This interim remedial action is not a final decision on the regional groundwater cleanup. If extraction and treatment in the "hot spot" is successful, the proposed remedy can be expanded through a separate EPA decision document to become a larger network of extraction wells to remove more contaminated groundwater from the fractured bedrock

- This interim remedy is not required to meet ARARS because it is not the final remedy decision. The final and permanent remedy decision in regard to the regional groundwater remediation shall be made by EPA in a separate decision document following the evaluation of the interim remedy.

DEP hereby concurs with EPA's proposed remedy with the following conditions:

- Concurrence with the remedy should not be interpreted as acceptance of Operation and Maintenance by the Department. This is entered into during design of the remedy and the completion of a State Superfund Contract.

- EPA will assure that the Department is provided an opportunity to fully participate in any negotiations with responsible parties.

- The Department will be given the opportunity to review and comment on documents and concur with decisions related to the design and implementation of the remedial action.

- Public comment and the issuance of an Explanation of Significant Differences must occur before any modification of the ROD.

- DEP reserves the right and responsibility to take independent enforcement actions pursuant to state law.

Thank you for the opportunity to comment on this EPA Record of Decision. If you have any questions regarding this matter, please contact me at 717-705-4853.

Sincerely,

Michael R. Steiner
Regional Director